

# ELECTRICAL REVIEW

FRIDAY  
5 SEPTEMBER 1961

WEEKLY  
PRICE 1s 6d



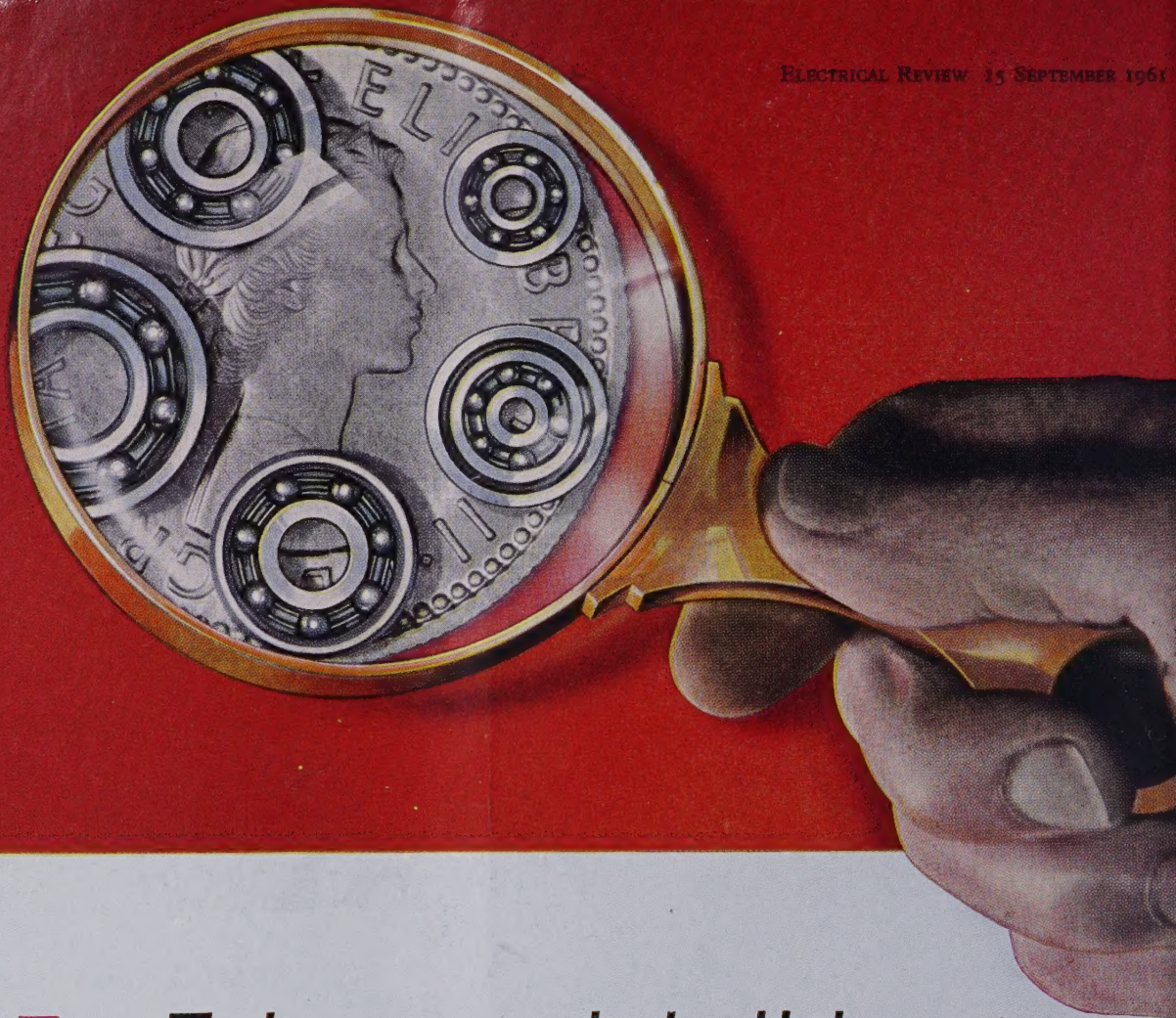
This new works at Stafford is now in full production for the manufacture of 'ENGLISH ELECTRIC' large and medium size transformers.

**'ENGLISH ELECTRIC'**  
**transformers**

CIRCULATION COPY 1

TRANSFORMER DEPARTMENT, STAFFORD  
The English Electric Company Limited, English Electric House, Strand, London, W.C.2





## RECIPE— *Take enough ball-bearings to cover a sixpence*

Many go into precision instruments—but whether the rest end up in something very hush-hush or not is rarely known to us.

But we have been making them for many years now; they range in size from 1.5 mm. o.d. upward. Some are made with open cups which allow clearance for spindle extensions, ranging from 0.25 upwards.

BELOW ARE  
SOME OF THEM,  
ACTUAL SIZE

Full particulars and sizes are available on application.

FAFNIR BEARING COMPANY LIMITED WOLVERHAMPTON

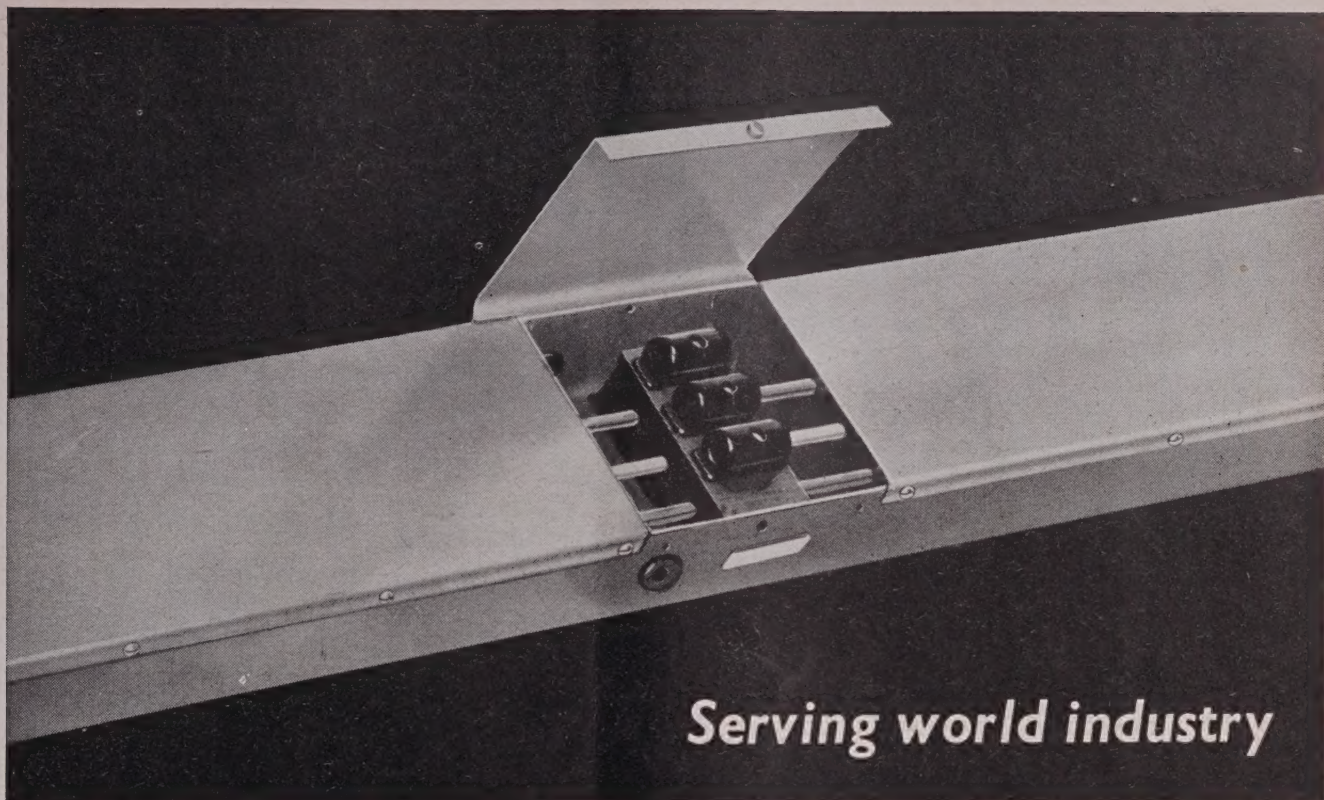


## MINIATURE BEARINGS

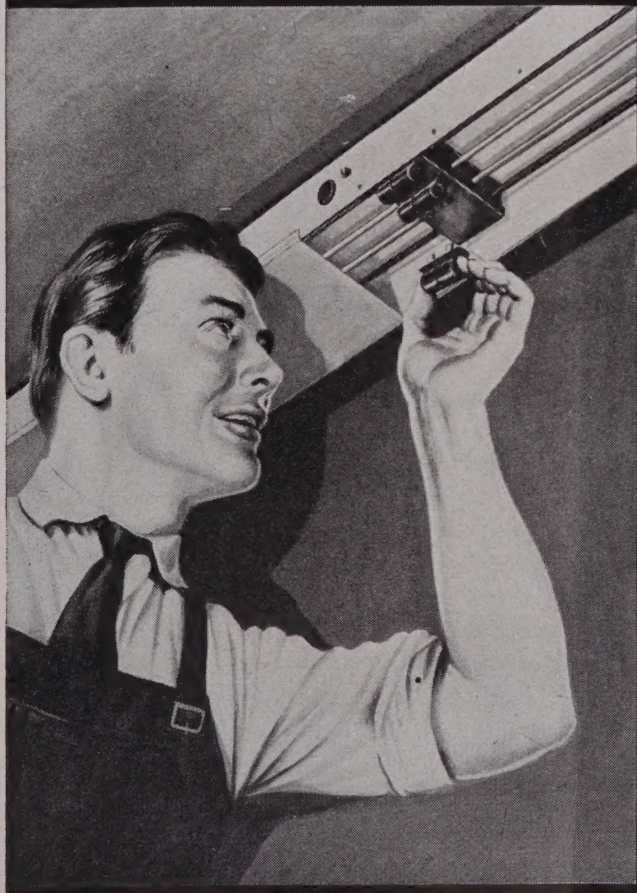
**F·B·C**  
**FAFNIR**

REGD.  
TRADE  
MARKS:  
FBC FAFNIR





## Serving world industry



OTTERMILL BUSBAR TRUNKING is known and respected throughout most of the engineering world. Easily, cheaply and quickly installed it gives you instantaneous plug-in power at two-foot intervals.

### *Its advantages?*

Complete planning flexibility, giving the works engineer a chance to wield complete control over workshop and production line layout. He knows there will be electric power wherever he wants it without a moment's interruption in main power supplies.



# OTTERMILL

Write for details:

**OTTERMILL SWITCHGEAR LTD.**

SALES OFFICE: 166 VICTORIA STREET, LONDON, S.W.1

Telephone: ABBey 5095/6 Grams: Busbar, Sowest

WORKS: OTTERY ST. MARY, DEVON

Tel.: Ottery St. Mary 500 Grams: Busbar, Ottery St. Mary





**simply  
a matter  
of  
confidence**

Ask any experienced electrical man. He'll tell you right away that you can have absolute confidence in anything Sanders make. No ifs, buts or doubts. If it's a Sanders job it's the best obtainable and it will never let you down. Take the SANDALINE Fuseboard, for instance, designed to meet today's modern requirements. With its ingenious smooth line case, detachable ends and sides, the 'Sandaline' has easily reversible fusebanks all making for ease and speed of wiring. Rewirable or H.R.C. Fuse Carriers can be fitted at will, since the 'Sandaline' has the tried and proved 'Sandaspeed' Duplex Fuse Units originated by Sanders. Absolutely rigid and dustproof, and incorporating a cylinder type lock with interchangeable keys, the 'Sandaline' Fuseboard is finished in steel-hammered grey stove enamel inside and out. But that's not all. It's a quality job. It's that little bit better than the best. In short, it's a Sanders job.

**SANDERS**

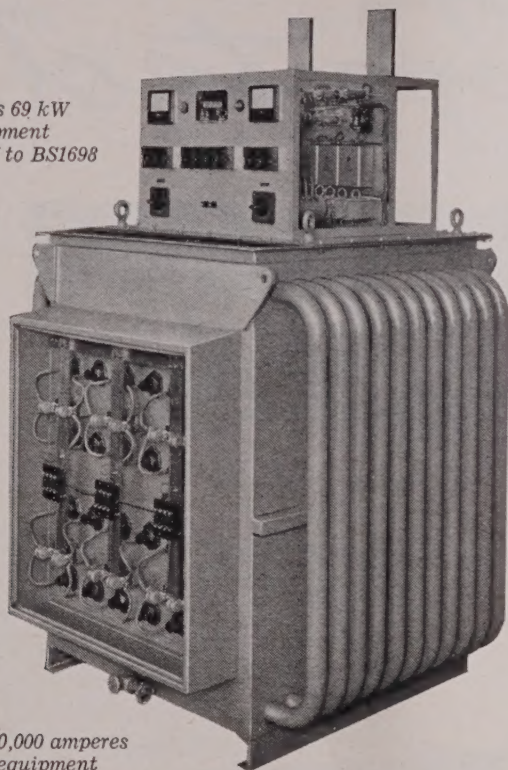




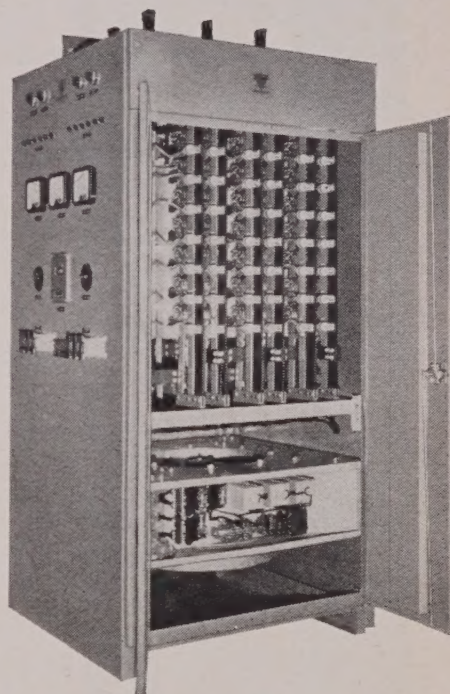
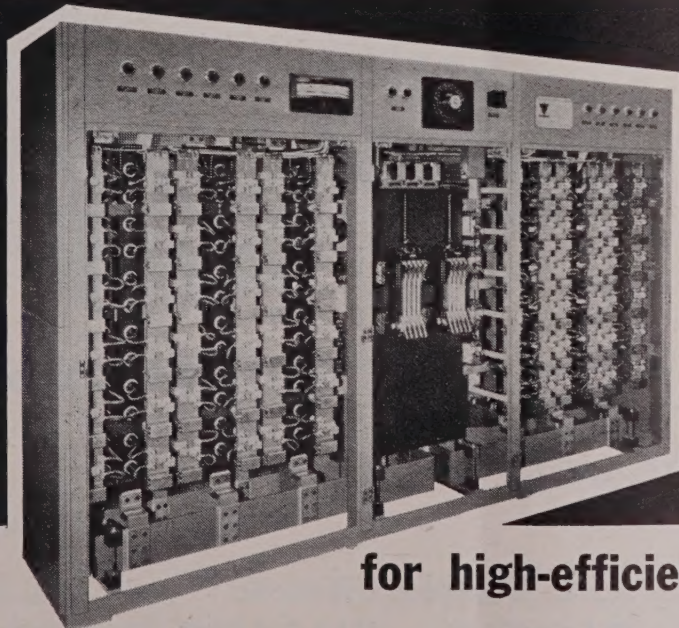
# SenTerCet

## SILICON RECTIFIER EQUIPMENT

115 Volts 600 amperes 69 kW  
silicon rectifier equipment  
Overloads to Class V to BS1698



Part of a 65-130 Volts, 20,000 amperes  
2.6 MW silicon rectifier equipment  
Overloads to Class II BS1698



240/480 Volts 3 wire 1000 amperes 480 kW  
silicon rectifier equipment Overloads to  
Class II BS1698

### Electro-Chemical

- Electrolytic processes
- Metallurgical and chemical industries

### D.C. Sub Station

- Industrial
- Dockside
- Change-over schemes
- Variable speed drives

**for high-efficiency AC to DC conversion**



## Standard Telephones and Cables Limited

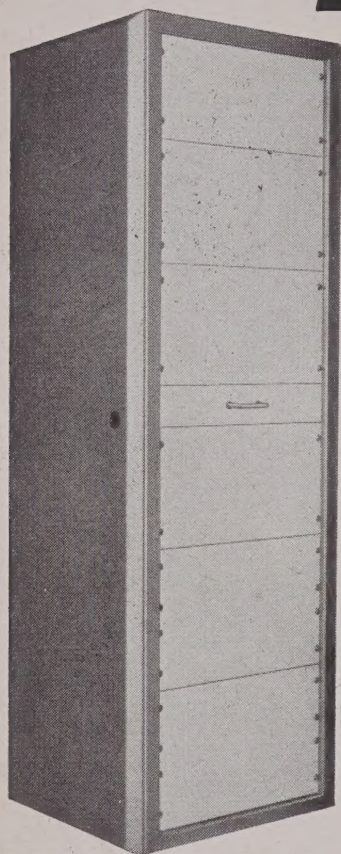
RECTIFIER DIVISION: EDINBURGH WAY • HARLOW • ESSEX



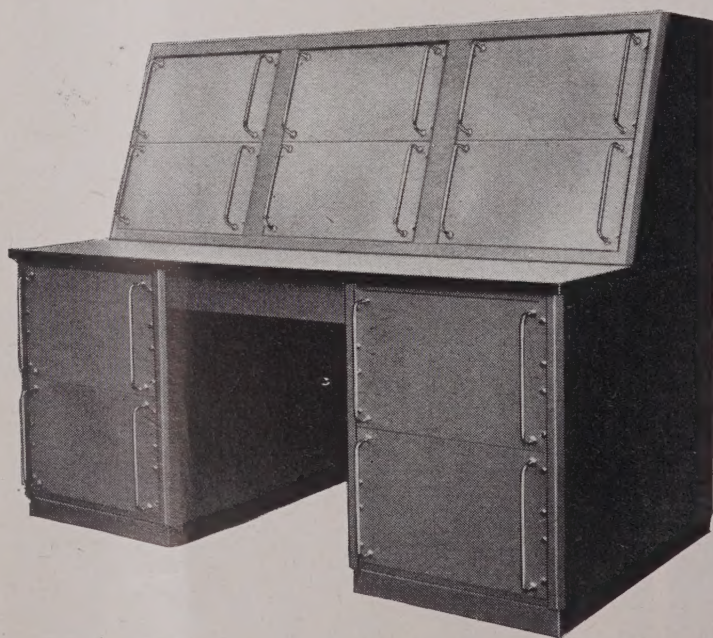
# **TO HOUSE YOUR VALUABLE ELECTRONIC EQUIPMENT**

## *Contact*

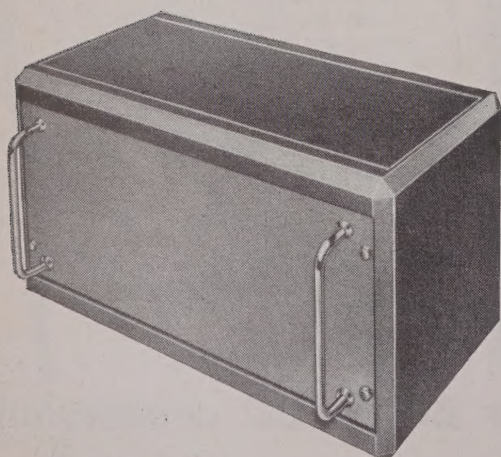
## Datum



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**CONSOLES**



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also **CABINETS**  
**PANELS • CHASSIS UNITS**



**DATUM METAL PRODUCTS LTD.**

COLNE WAY TRADING ESTATE • WATFORD-BY-PASS • WATFORD • HERTS

Telephone: Watford 22351  
Telegrams: Datum, Watford



# Medium-size a.c. motors

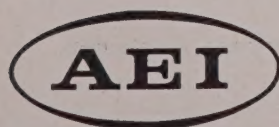
## FROM STOCK

### IMMEDIATE DELIVERY

is offered of all the following foot-mounted induction motors.  
The ratings listed are for 400/440 volt, 3-phase, 50-cycle supplies.

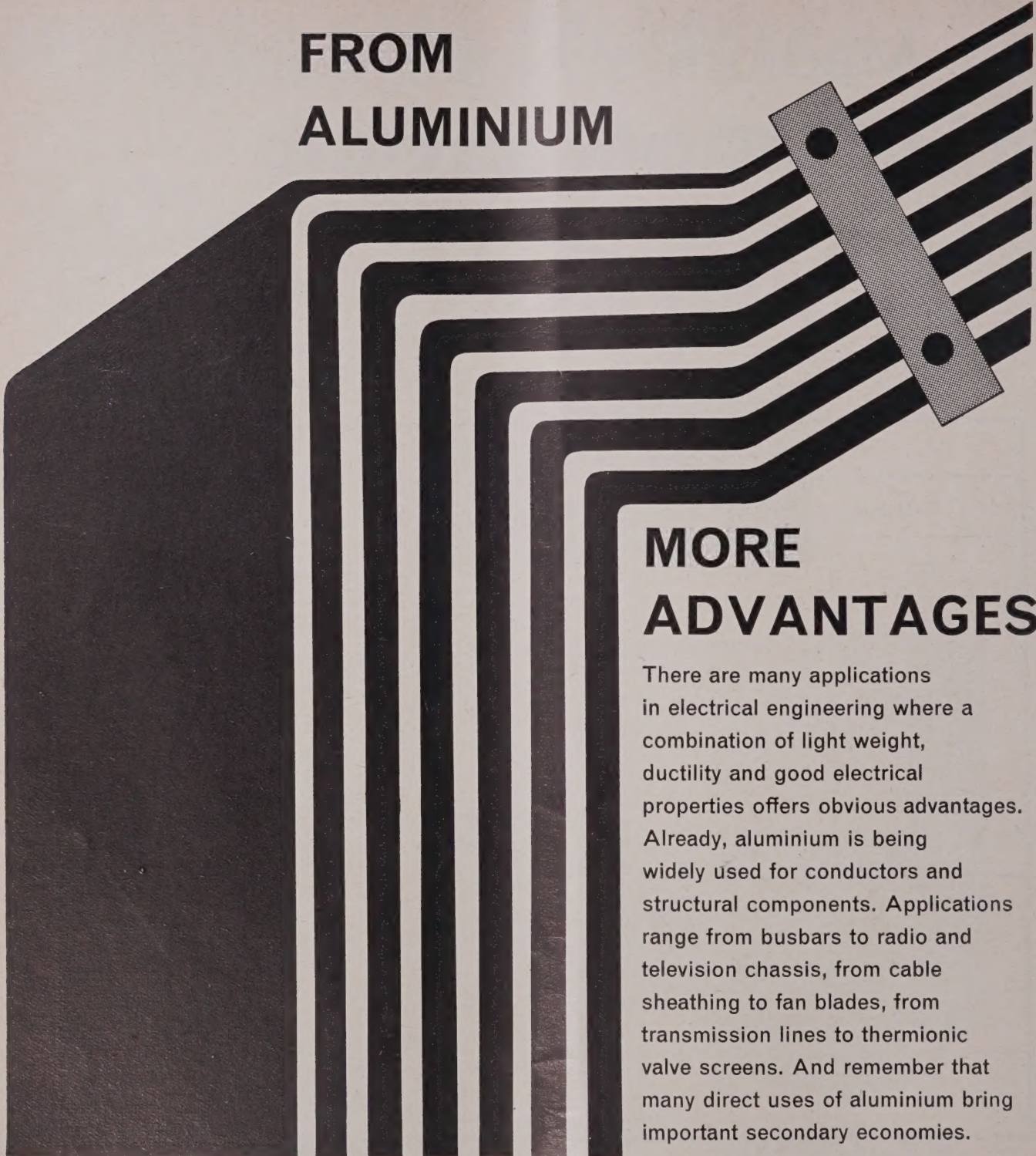
SQUIRREL CAGE (BS 2613)			
Screen-protected		Totally enclosed fan-cooled	
<i>h.p.</i>	<i>speed r.p.m.</i>	<i>h.p.</i>	<i>speed r.p.m.</i>
30	970	25	730
30	725	50	730
50	725	†65	1475
*55	720	†65	975
70	720	†80	1465
*75	970	†85	950
100	1455	100	1480
100	725	†100	1450
*125	1465	†125	980
*130	970		
SLIPRING (BS 2613)			
Screen-protected		*drip-proof enclosure † totally-enclosed closed air circuit motors, radiator cooled.	
<i>h.p.</i>	<i>speed r.p.m.</i>		
30	965		
50	1450		

For further details of these and other AEI stock motor ranges, please contact your local AEI district office or Industrial Machines Dept., Mosley Road Works, Trafford Park, Manchester 17. Telephone No. Trafford Park 2431. Extension 1212.



**Associated Electrical Industries Limited**  
**Motor & Control Gear Division**  
 RUGBY AND MANCHESTER, ENGLAND





**FROM  
ALUMINIUM**

**MORE  
ADVANTAGES**

There are many applications in electrical engineering where a combination of light weight, ductility and good electrical properties offers obvious advantages. Already, aluminium is being widely used for conductors and structural components. Applications range from busbars to radio and television chassis, from cable sheathing to fan blades, from transmission lines to thermionic valve screens. And remember that many direct uses of aluminium bring important secondary economies.

**impalco**



**aluminium**

*Imperial Aluminium Company Limited • Birmingham*



# HURSEAL

## TURNS ON THE HEAT WITH A NEW ALL-COLOUR ADVERTISING CAMPAIGN



## decor- designed

**ELECTRIC PANELS permanently oil-filled**

Through the medium of the Home Magazines, Hurseal are urging readers to **BE MODERN MINDED ABOUT HEATING**. The powerful selling points which are being driven home are these . . .

- \* Contemporary decor-designed panels to harmonise with home decoration.
- \* Any length supplied to specific requirements (Conforming to the principle that radiators *must* be full window width for maximum efficiency).

- \* Safety—no risk of fire, burns or scorching.
- \* Economy—NO BIG OUTLAY OR INSTALLATION PROBLEMS.

The HURSEAL PORTABLE MODEL will be specially featured this Autumn—it *can* be your customers' first step to complete home-heating the simple Hurseal way. So keep one on display. And, remember, that although standard colours are bronze and cream, Hurseal Panels can be supplied in any B.S.S. Colours.



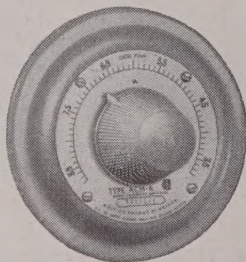
**POWELL DUFFRYN HEATING LTD**  
VALE ROAD, CAMBERLEY, SURREY





## Trust a Maclaren!

Yes! trust a MACLAREN to provide calculated comfort! Approved by the Design Council, the MACLAREN ACMR Room Thermostat combines attractive appearance with the most accurate performance. Suitable for controlling all forms of Space Heating, the MACLAREN ACMR is ideal for Electric Storage Heating. Much of the success of the major Under-Floor Warming Installations in the U.K. can be attributed to the ACMR. Where quality is essential specify the Thermostat you can trust — it's a MACLAREN!



# "MACLAREN"

**ELECTRIC THERMOSTATS**

**ROBERT MACLAREN & CO. LTD., EGLINTON WORKS, KILBIRNIE STREET, GLASGOW, G.5**

London Office: 75 George Street, Portman Square, W.1. Manchester Office: 120/126 Portland Street, Manchester 1. Midlands Office: 61 Bridge Street, Walsall



# 'HIDUTAC' switchfuses break 8 times their rated full load current

This high breaking capacity is made possible by cam-operated, silver contact, double-break "interruptor" units—just one of many 'Hidutac' exclusive features resulting from the *new approach* of the G.E.C. Installation Equipment Group to switchgear design. The *new approach* has crystallised from G.E.C.'s many years' experience of making switchgear superbly well.



Consider these other impressive advantages: *Unlimited full load switching*—'Hidutac' switchfuses operate at their full load current with unfailing reliability. *A unique compactness*, brought about by radial positioning of contacts. Generous wiring space and easy access to terminals at the front. *Total internal enclosure* of all moving parts, with shields over live terminals. *High fault current protection* in Single Pole and Neutral, Double Pole, Triple Pole and Neutral switchfuses with H.R.C. or rewirable fuses. Categories of duty are: H.R.C. fuses, all ratings, AC4 of BS88 (33000 amp); rewirable fuses, 15 and 30 amp ratings, S2A of BS3036 (2000 amp); rewirable fuses, 60 amp rating, S4A of BS3036 (4000 amp). *Modern styling* of pressed steel case with fully interlocked cover.

These exclusive features make 'Hidutac' switchfuses vastly superior for tungsten and discharge lighting control, motor control, and transformer and capacitor switching.

**IMMEDIATE DELIVERY** of 'Hidutac' switchfuses from wholesalers throughout the country. For more detailed information ask your wholesaler for 'Hidutac' literature.



that's the New Approach of **G.E.C.**

INSTALLATION EQUIPMENT GROUP





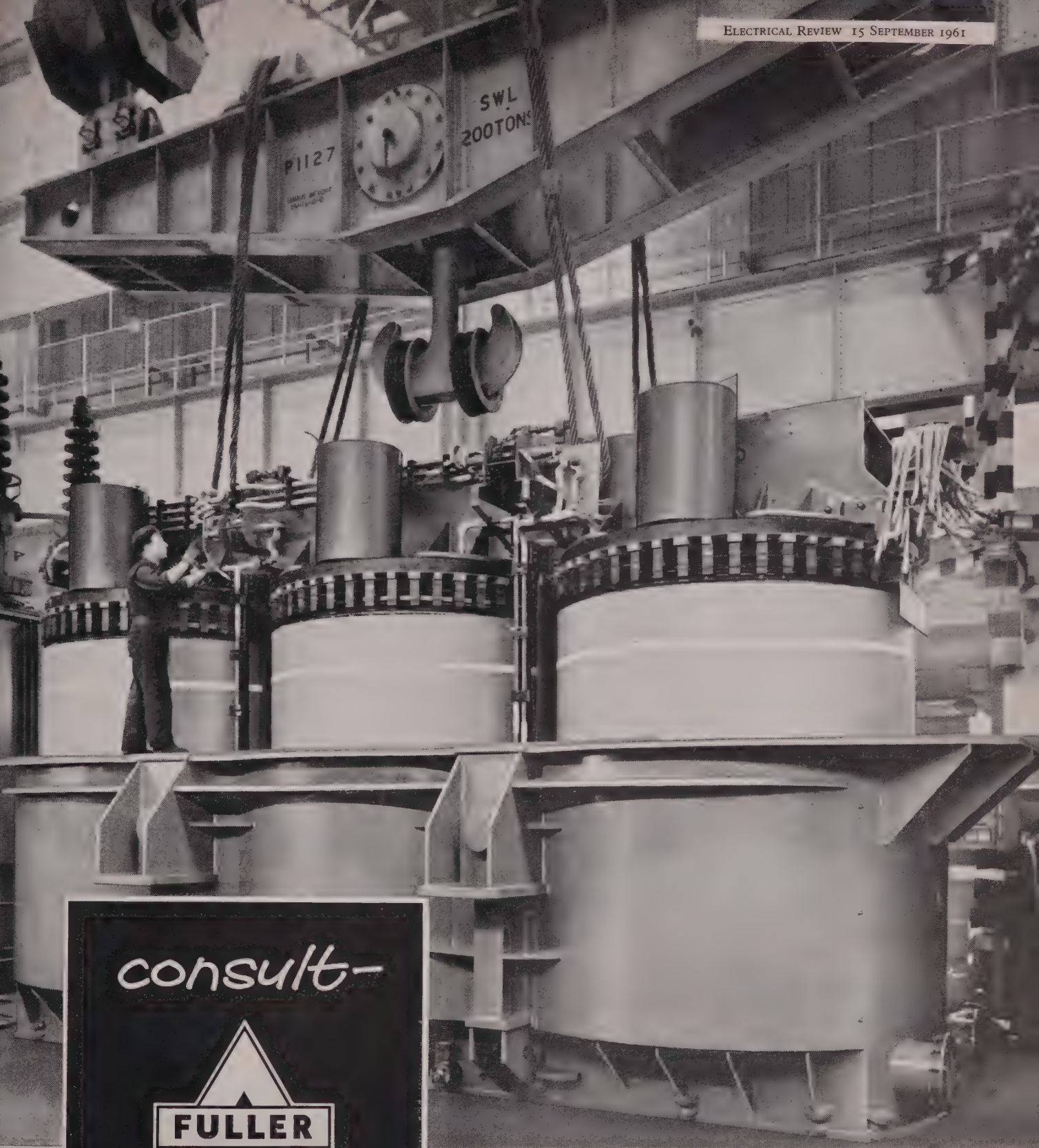
## The Romans too had a word for it. . .

As a matter of fact, they had three words for it. So have we, but they are not the same. To the Romans, PARVALUX meant "Light But Little". To us, it means Fractional Horse-power Motors—and that is what it means to our numerous customers, organisations whose names are known the world over. And so, of course, the name PARVALUX is known all over the world, too. When we are asked to build a machine, years of skill and craftsmanship go into its construction. That is why intricate specifications never worry us. We also have a very extensive range of standard f.h.p. motors and gear units, with horsepowers varying from 1/300 to 1/5, yet even these can be modified to suit any customer's special requirements. If PARVALUX also meant "versatile", we should not be at all surprised.

*Fractional Horse-power Motors by...*

REGISTERED TRADE MARK  
**PARVALUX**  
LIMITED





*One of the two Rectifier Transformers under construction at our Works for the C.E.G.B. Lydd Terminal Station of the Cross Channel D.C. Power Link. These units are rated at 95/95/65 MVA 284/83.6/33 kV and are believed to be the largest in the world.*

consult-



A member of the Hawker Siddeley Group

Sole U.K. representatives for ASEA Sweden  
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 Telephone: LARKSWOOD 2350

Also at Birmingham, Glasgow and Manchester

Modern plant and more than 40 years' experience ensure that we are particularly well-equipped to manufacture transformers up to the largest sizes and the highest voltages. Thanks to our long association with ASEA of Sweden, we have access to an unrivalled experience of 380kV practice. Our up-to-date equipment includes a large vacuum drying chamber, a 200 ton coil pre-shrinkage press and comprehensive plant for both routine and impulse testing.





Price  
Reduction

The **SANTON**  
'DUAL'

**ELECTRIC IMMERSION HEATER.**

The perfect dual purpose heater with a SEPARATE CONTROL unit which enables your customer to obtain the maximum benefit from the heater's Bath-Sink elements.

The control can be fitted in any position most convenient to the user, and where it can be seen at a glance which element is on, Bath or Sink. In this way your customer will not pay for more hot water than is required, for with the visual control the busy housewife will not heat unnecessary quantities of water through forgetfulness.

Sell your customer economic electric water heating at the new reduced price.

	Heater	P. Tax	Thermostat	Control Switch.
23", 27" & 30"	£3 5 0	13 1d	£1 15 0	£1 10 0
36" ... ..	£3 10 0	14 1d		
42" ... ..	£3 15 0	15 1d		



**FULL DETAILS  
AVAILABLE ON  
REQUEST.**

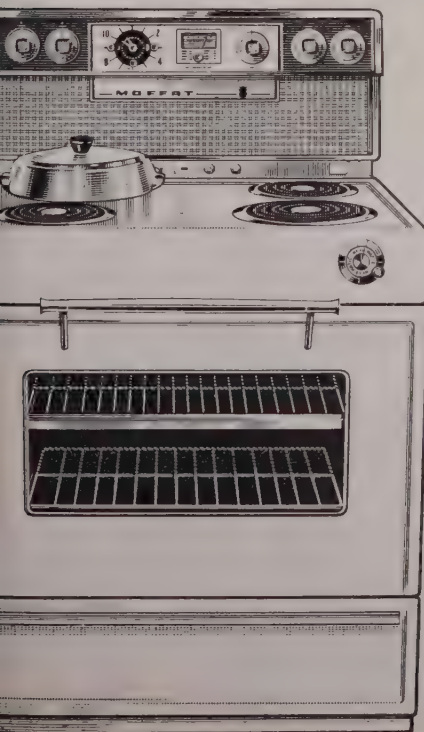
Telephones:  
Newport 71711  
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# MOFFAT

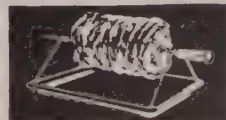
## The cooker that collects a crowd



Crowds gather wherever there's a MOFFAT on view. That's general experience in showrooms all over the country! People don't need coaxing . . . the sight of the cooker alone is enough to make them admire—and buy! It's the features that fetch them . . . features that every woman's looked for in other cookers but never found till now. In MOFFAT, the cooker that's so easy to sell! Now in a wide range of prices and styles—Free Standing or 'Built-In' versions (to fit a custom kitchen) or the new Fiesta cabinet model.

**A COMPLETE RANGE OF MODELS IS AVAILABLE IN 24", 30" AND 40" SIZES AS WELL AS BUILT-IN OVENS AND SURFACE UNITS.**

*Write for details or, better still, see the whole MOFFAT range at our Showrooms at Moffats Limited, 37 Davies Street, London, W.1. We welcome trade enquiries at any time.*



#### ROTISS-O-MAT SPIT

Quickest, most flavoursome way to roast. Self-basting seals in flavour, juices, goodness—stops meat shrinkage. Uses regular oven thermostat settings. Can be timed with automatic clock.



#### HI-LO-MATIC SHELF

Precision grilling and baking are matters of turning an elevator knob. The shelf can be raised or lowered without opening oven door. Oven preheats to 350° in just over 4 minutes!



#### THERM-O-GUARD HOTPLATE AND DEEP WELL COOKER

This thermostatically controlled hotplate makes every utensil fully automatic! Clock-control allows absentee operations. Accommodates exclusive Deep Well Cooker/Deep Fat Fryer.




#### ROAST METER

Now—joints are cooked automatically! The preference (rare, medium, well-done) is dialled, the electric meat thermometer probe is thrust into the joint . . . and buzzer signals when it's done—to perfection.

# MOFFAT





# TETRA TUBULAR SHEATHED-MINERAL EMBEDDED ELEMENTS

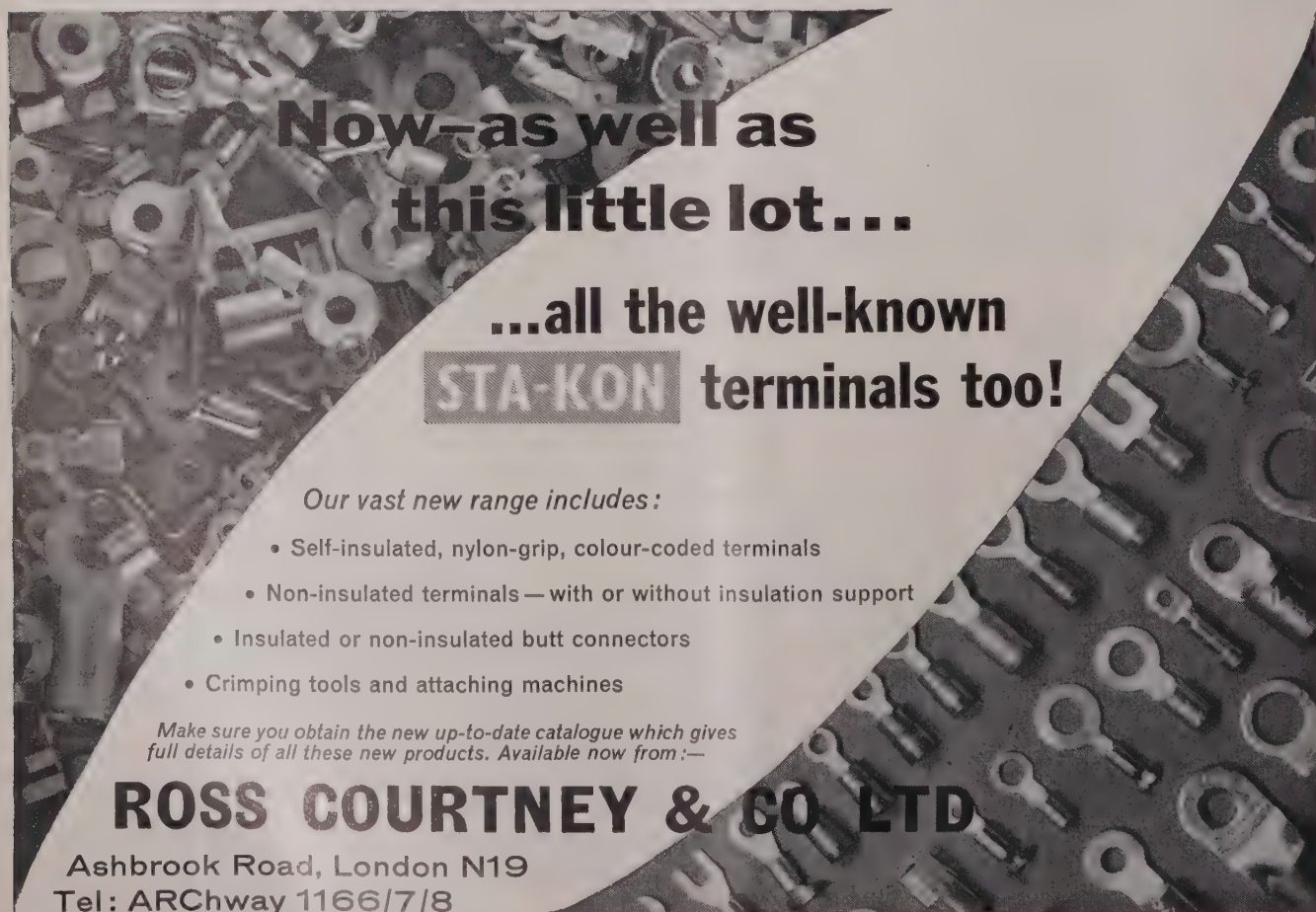
Selected for their high efficiency and economy Tetra Elements combine high dielectric strength and insulation resistance with good heat transfer and distribution.

**TETRA FINROD** elements for oil pre-heating; convection heating; infra-red drying of grain, rubber, tobacco, timber and many other applications; heat exchangers and defrosting of commercial refrigeration equipment.

**Plain or finned, Tetra elements efficiently heat water, air, oil, chemicals and metals.**

*Your enquiries are cordially invited*

THE TETRA ENGINEERING CO. LTD. TETRA WORKS, NORTH END ROAD, WEMBLEY, MIDDX. Tel: WEMbley 1066 (5 lines)



## Now—as well as this little lot...

## ...all the well-known STA-KON terminals too!

*Our vast new range includes:*

- Self-insulated, nylon-grip, colour-coded terminals
- Non-insulated terminals — with or without insulation support
- Insulated or non-insulated butt connectors
- Crimping tools and attaching machines

*Make sure you obtain the new up-to-date catalogue which gives full details of all these new products. Available now from:—*

# ROSS COURTNEY & CO LTD

Ashbrook Road, London N19

Tel: ARChway 1166/7/8



# ELECTRICAL PORCELAIN ENGINEERING

## BY DOULTON

Backed by a century and a half of ceramic manufacture, a first class research laboratory, a modern factory, a highly trained technical staff and the latest test equipment, Doultons offer an unrivalled service to the electrical engineering world.

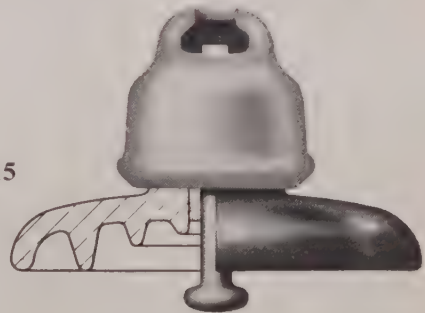
Doulton Insulators are made for standard voltages spanning a range of 400 to 400,000 volts. Many hundreds of thousands are in use to-day over the world's surface.

Three typical designs of high voltage insulators in general use are shown below.



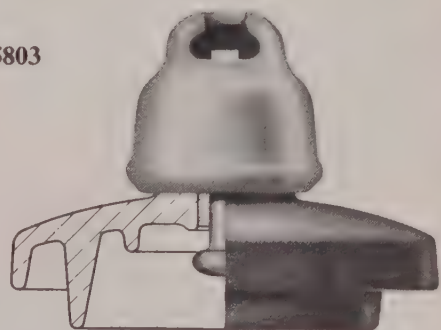
### 33 kV Pin Insulator, Type BC. 28

Complying with B.S. 137/1960  
Minimum Failing Load 2400 lb.



### Disc Insulator, Type P.42B/8/5515

Complying with B.S. 137/1960  
Minimum Failing Load 42000 lb.



### Disc Insulator, Type F.42B/6 1/2/5803

Complying with B.S. 137/1960  
Minimum Failing Load 42000 lb.

*Write to Publicity Department  
for latest literature*

## DOULTON INDUSTRIAL PORCELAINS LIMITED

ROYAL DOULTON POTTERIES, WILNECOTE, TAMWORTH, STAFFS.







## These cables will be as good as new in A.D. 2011

These gangers and jointers are laying cables made with aluminium conductors. It's a sight that is becoming increasingly familiar in British cities, from London to Glasgow. It means power PLUS for homes, factories, offices and mines. The PLUS is Alcan aluminium in those conductors. They will still be carrying their load 50 years from now.

The gangers are installing 4 core ·3 sq. in. low-voltage distribution cables. Aluminium is also increasingly used in high-voltage and extra-high-voltage feeders. It has great advantages for the sheathing of pressure-type cables. Jointing presents no problems.

Today, aluminium is the cheapest conductor material. Alcan production capacity and Alcan research make sure that it will hold its lead.

Cable manufacturers can give you further advice on aluminium cables. Write to them, or write to us:  
Alcan (U.K.) Limited,  
Aluminium Canada House,  
30 Berkeley Square, London W.1.  
Telephone: Mayfair 9721.

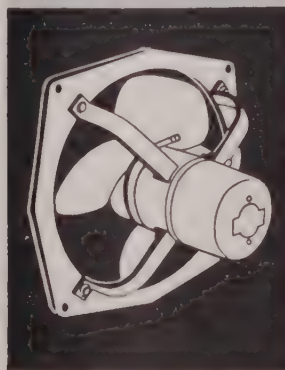
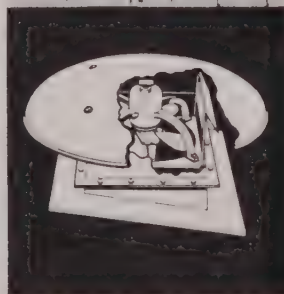
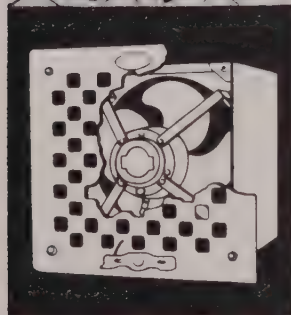
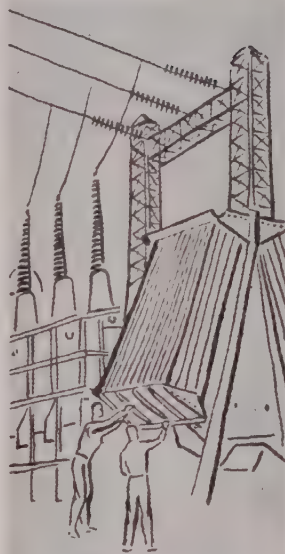
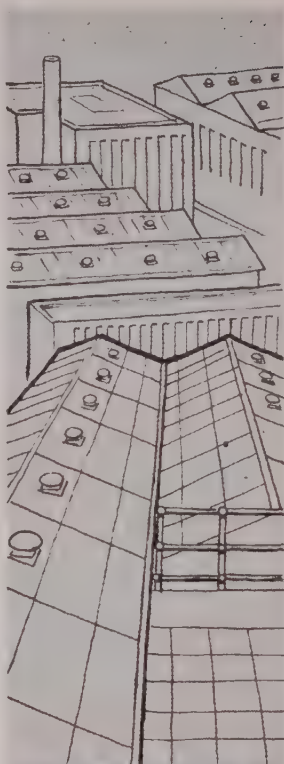


Britain's most widely used  
aluminium — from Canada

# ALCAN







**Fenton Byrn wall fans** are purpose-made for installation in offices . . . kitchens . . . hospitals . . . licensed premises . . . clubs . . . restaurants. Fenton Byrn wall fans . . . recess smoothly into walls to blend with any decor. There's high operational efficiency, and a choice of fixed or closable grilles. A wide range of sizes is available and black out attachments.

**Fenton Byrn roof ventilators** offer powerful, motorised **regulated** ventilation. They are fitted with automatic shutters—close as soon as the motor stops to eliminate back-draught. They are completely weather- and vermin-proof—and there's no heat loss.

**For those who want a ring fan . . .** Fenton Byrn ring fans in a wide range of sizes give long periods of maintenance-free service.

And for those who want a fan for special purposes, for manufactured units—heaters, underground ventilation plant, spray booths, etc.—Fenton Byrn can provide a fan to meet the need.

Fenton Byrn fans . . . backed up by research—And the Fenton Byrn advisory service is ready, willing and able to deal with your problems . . . to keep you ventilated.

*Ask for leaflets:*  
**Wall Fan, No. F/3/2;**  
**Roof Ventilator, No. F/8/1;**  
**Ring Fan, No. F/8/2.**

# Ventilation is needed . . . then see

## FENTON BYRN

### FENTON BYRN & CO. LTD.

West Molesey, Surrey  
 Telephone: Molesey 7777  
 Telegrams & Cables: Airlation East Molesey



# totally

Permali densified laminated wood insulation is used by electrical equipment manufacturers all over the world.

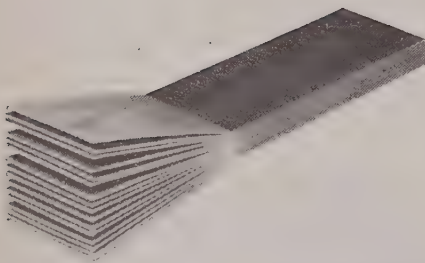
# tested

Every Permali component is backed by the full resources of the Permali Group—ample production capacity, labora-

# most

tory research and control, wide experience, complete design and fabrication service and expert representation.

# reliable



## PERMALI

**proved in performance over 30 years**

PERMALI LIMITED • GLOUCESTER • ENGLAND • Tel: 24941

Group factories in France, U.S.A., Canada and Australia.





PRESSURE SENSITIVE TAPES FOR ELECTRICAL USES

MANUFACTURED BY

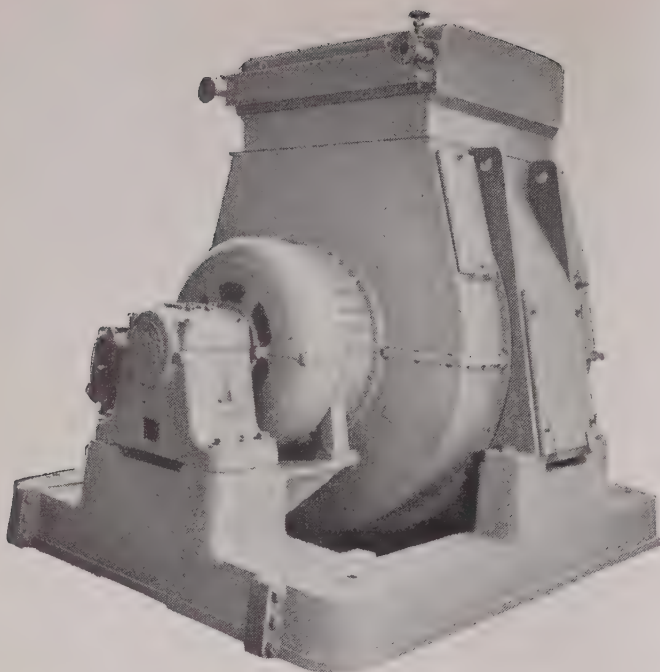
**PERMACEL** TAPES LIMITED

SLOUGH BUCKS TELEPHONE SLOUGH 25521



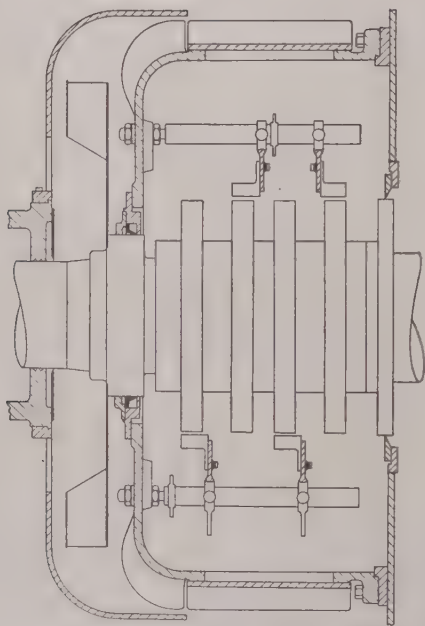
<sup>A</sup>  
*Johnson & Johnson*  
COMPANY





What do you—or any engineer—mean by the ‘design’ of a motor? Its electrical design? (Motors of the same type and power can be very much alike in this). Its looks? Or the form it takes: *how* it is put together? We think there is something of all these implied; along with the idea of the way various specific problems of detail have been met and dealt with. Such details distinguish one manufacturer’s machine from another because they depend, not on theory, but on experience; on how long the manufacturer has been in the game; on...

## This thing called know-how



Take the slip rings on a large T.E. water-cooled A.C. motor. They may be—and often are—within the main enclosure. But on Crompton Parkinson machines they are in a separately cooled chamber sealed off from the rest of the motor. There are two very important advantages in this arrangement. Firstly, carbon dust from brush wear does not get into the motor, where it is impossible to remove and accumulates from year to year. Secondly, access to the slip rings and brush gear is far easier: with the inspection covers removed there are no obstructions; the electrician can work close to the job and see exactly what he is doing. The enclosure is ribbed externally and cooled by its own fan. This is the kind of detail that 80 years of making motors helps one to get right.

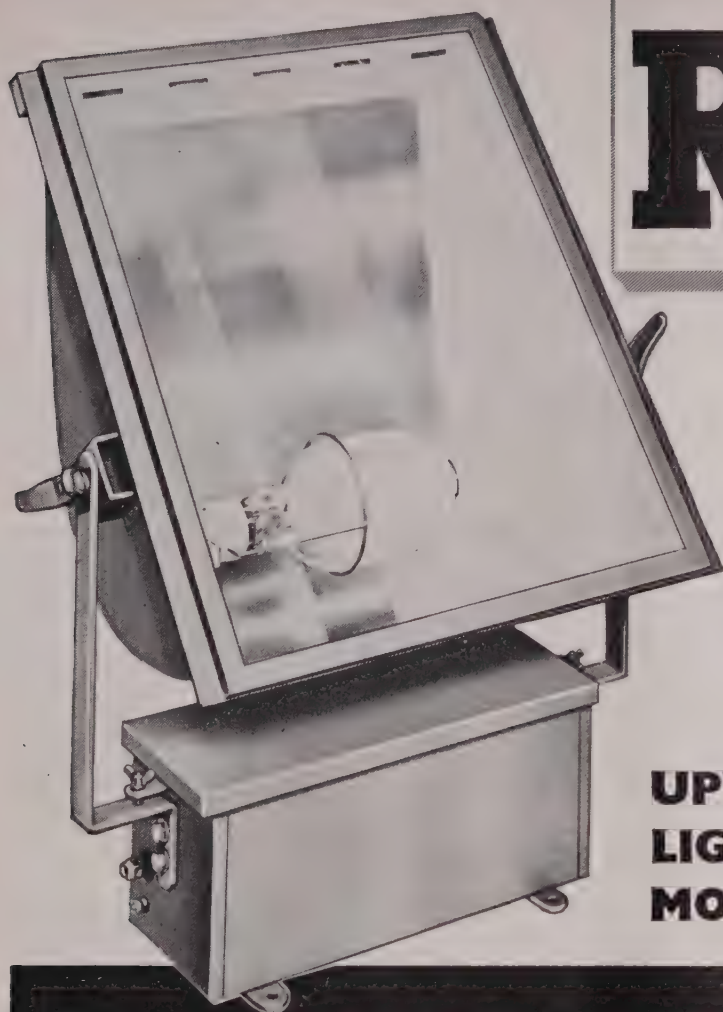
# Crompton Parkinson

LIMITED



Makers of Electric Motors of all kinds, A.C. and D.C. Generators, B.E.T. Transformers, Switchgear, Cables, Instruments, Lamps, Lighting Equipment, Batteries, Stud Welding Equipment, Traction Equipment, Ceiling Fans.




**R**

R.E.A.L. IS A REGD. TRADE MARK

**E**
**A**
**L**
**UPWARD  
LIGHTING  
MODEL**

## MERCURY FLOODLANTERN

for 250/400 watt MBF/U Lamps

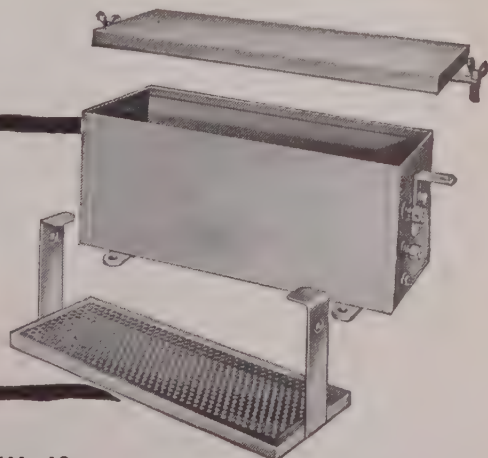
List No. 1231. This Weatherproof Lantern incorporates a Parabolic asymmetric Reflector 3" focus, and is suitable for short or medium range floodlighting of vertical surfaces.

It is just one of the R.E.A.L. range of Floodlansers comprising some fifty models and catering for practically every type and size of lamp.

### 'UNIVERSAL' CONTROL GEAR BOXES

List No. 1209. The perforated tray supplied with the R.E.A.L. Box greatly facilitates gear mounting.

Each Box fitted with packed glands for incoming and outgoing cables.



Have you yet received your copy of LIST P.6004?

ROWLANDS ELECTRICAL ACCESSORIES LIMITED, R.E.A.L. WORKS, BIRMINGHAM, 18

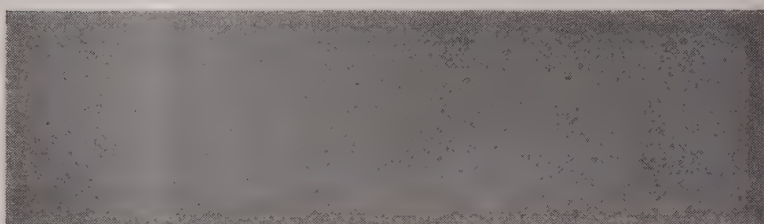


Following a field trial with 33kV flat cables, the Eastern Electricity Board has ordered two further installations for operation at Southend-on-Sea and St. Albans.

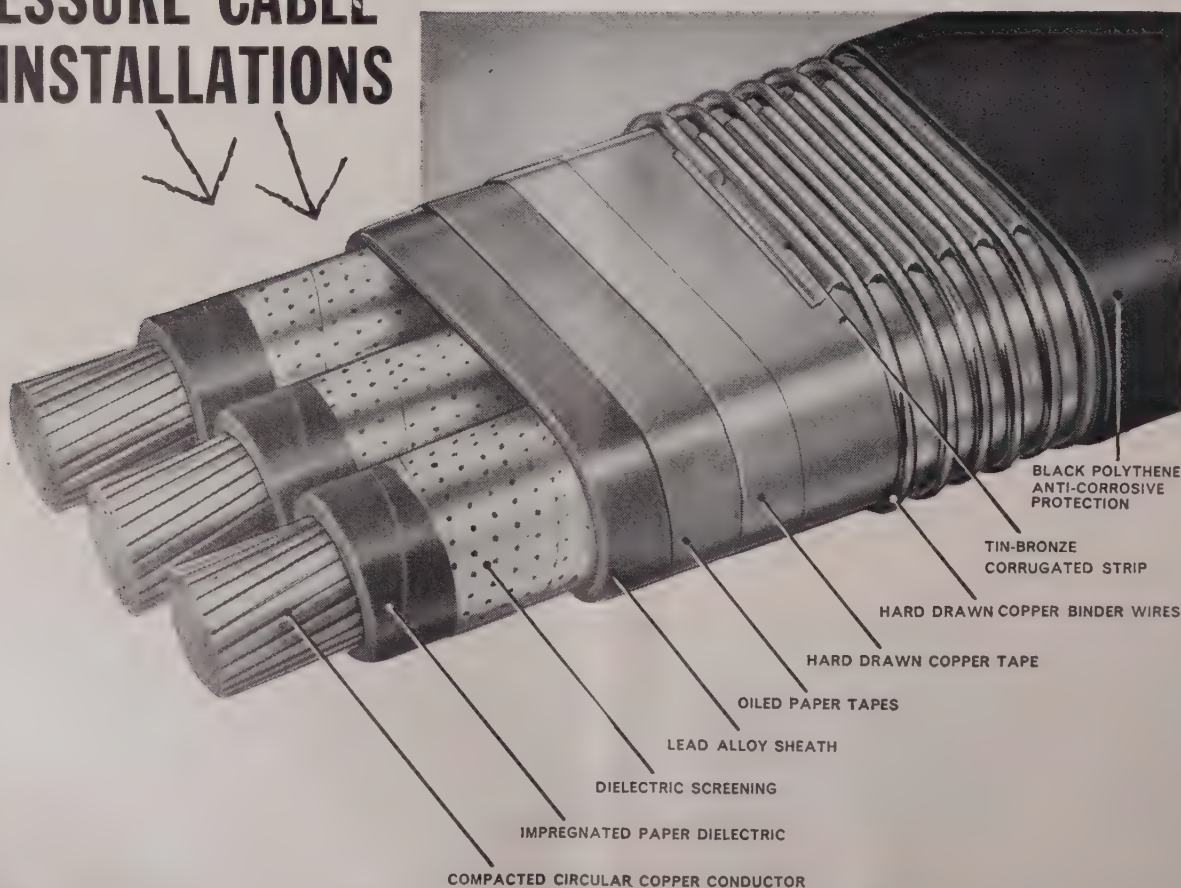
Flat Oil Filled Cable and its companion the conventional Oil Filled Cable, both manufactured by Enfield-Standard, meet all requirements for cable systems at 33kV.

# 33kV

## FLAT OIL FILLED PRESSURE CABLE INSTALLATIONS



*for Eastern Electricity Board*



**Enfield-Standard Power Cables Limited**

*Head Office and Works*

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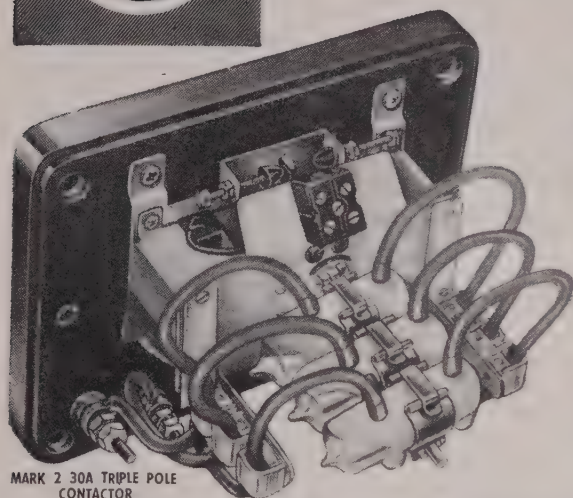
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Relays of the tilting mercury switch type are manufactured in sizes up to 200 amp. triple pole and in encapsulated pattern up to 30 amp. triple pole.

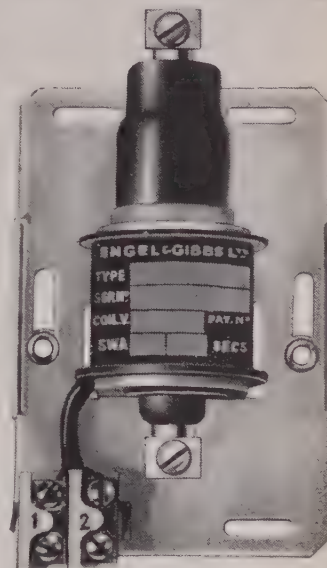
Metallic contact relays are available in plug-in version with contact ratings of 3 amp. 240v. A.C. double pole change-over arrangement.

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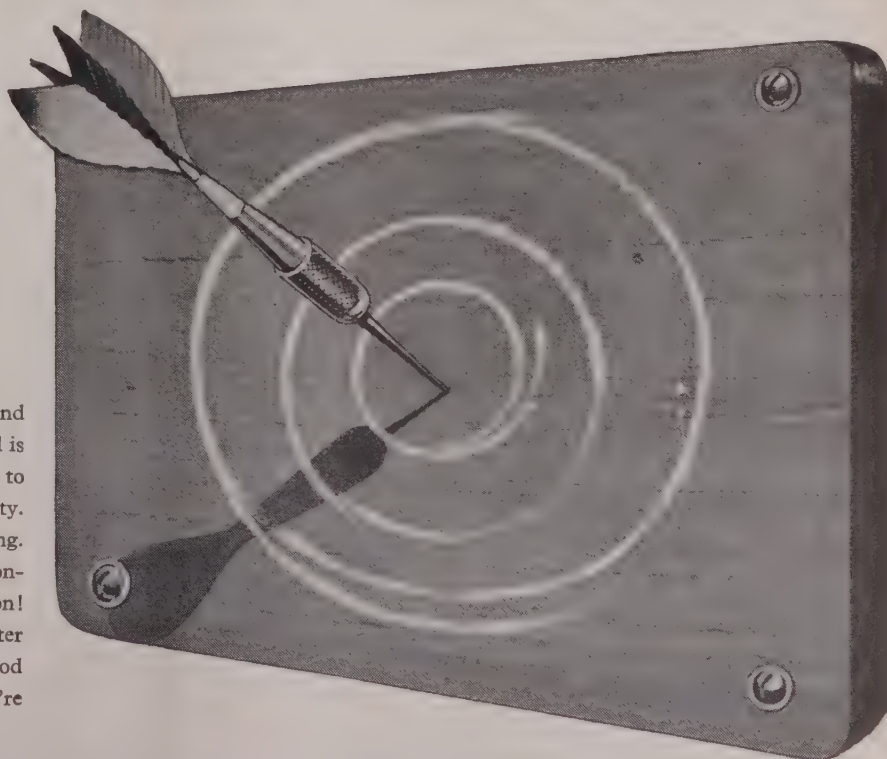


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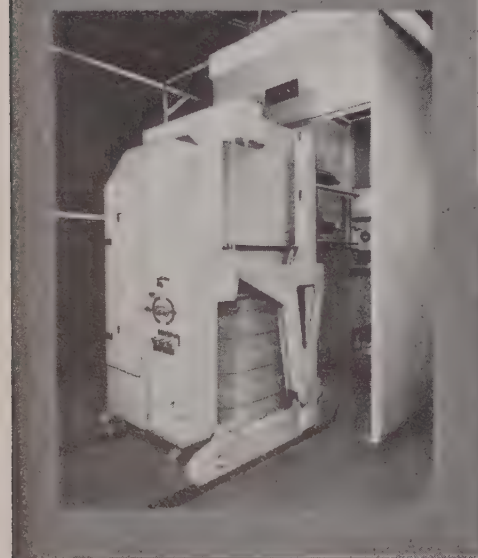
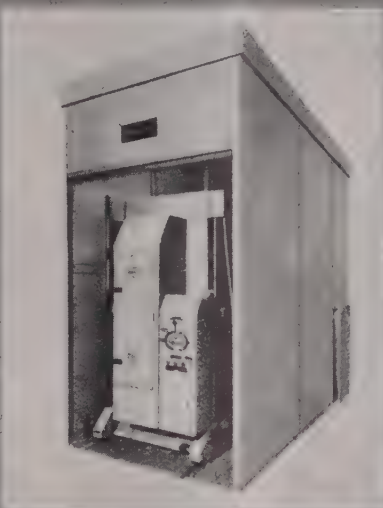
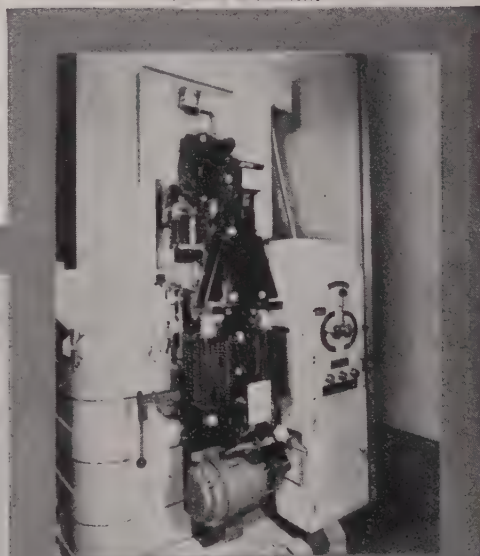
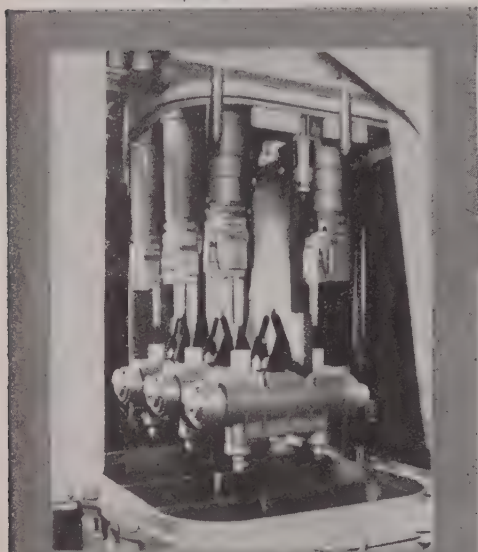
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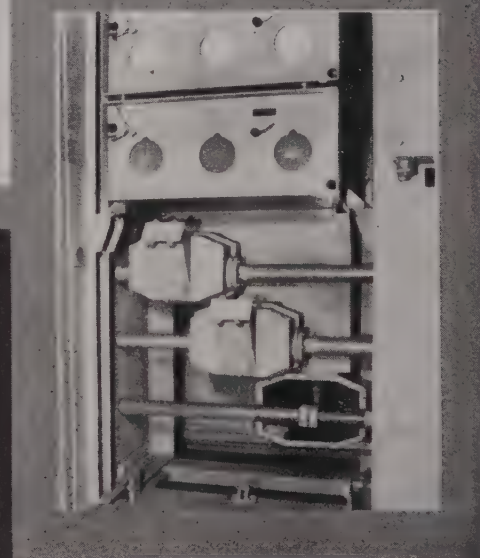
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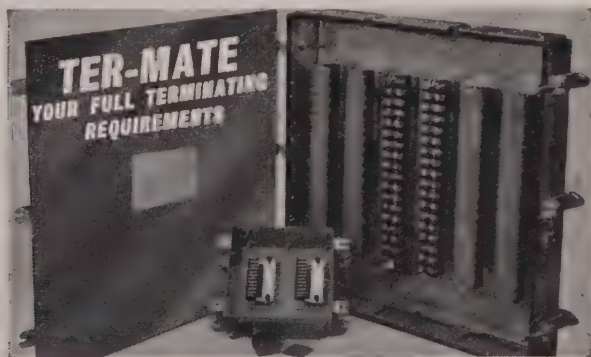
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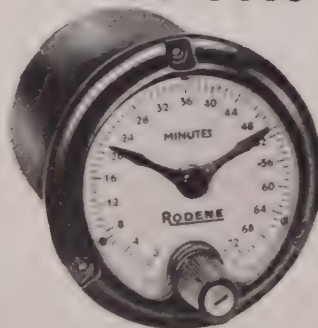
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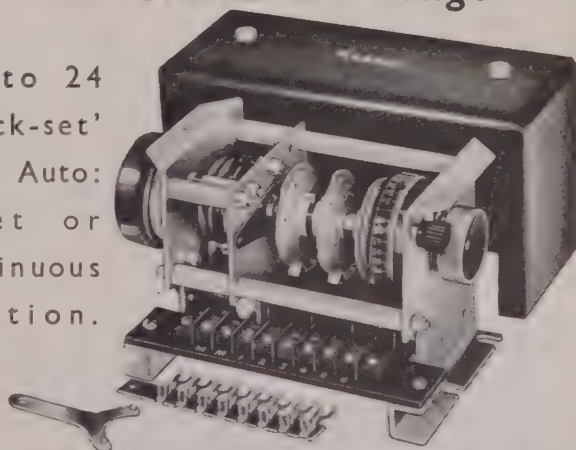
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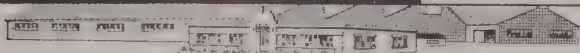
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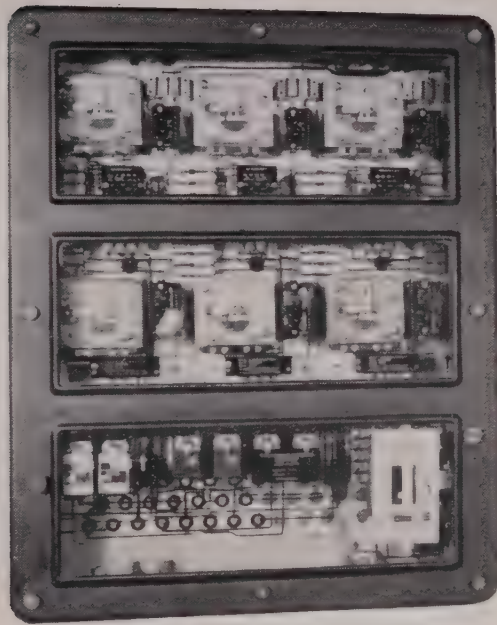
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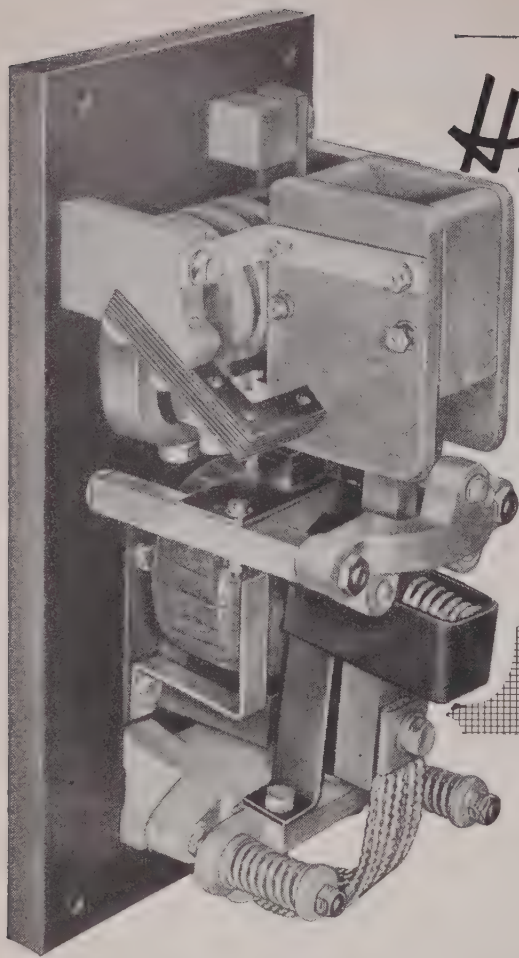
Reyrolle type-H high-performance distance protection  
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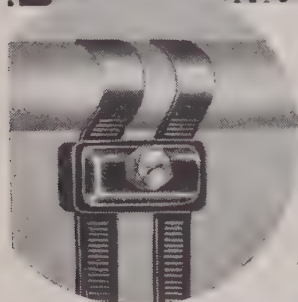
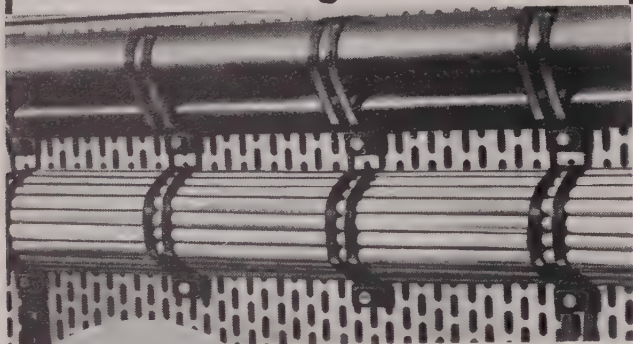
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## complete cable security –



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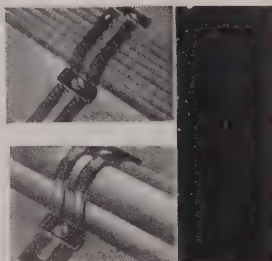
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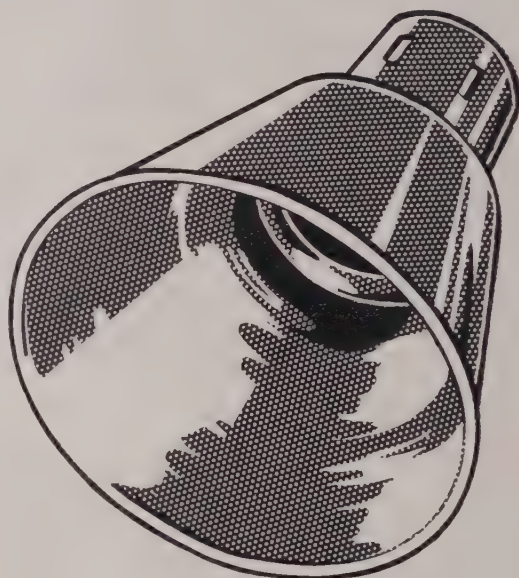
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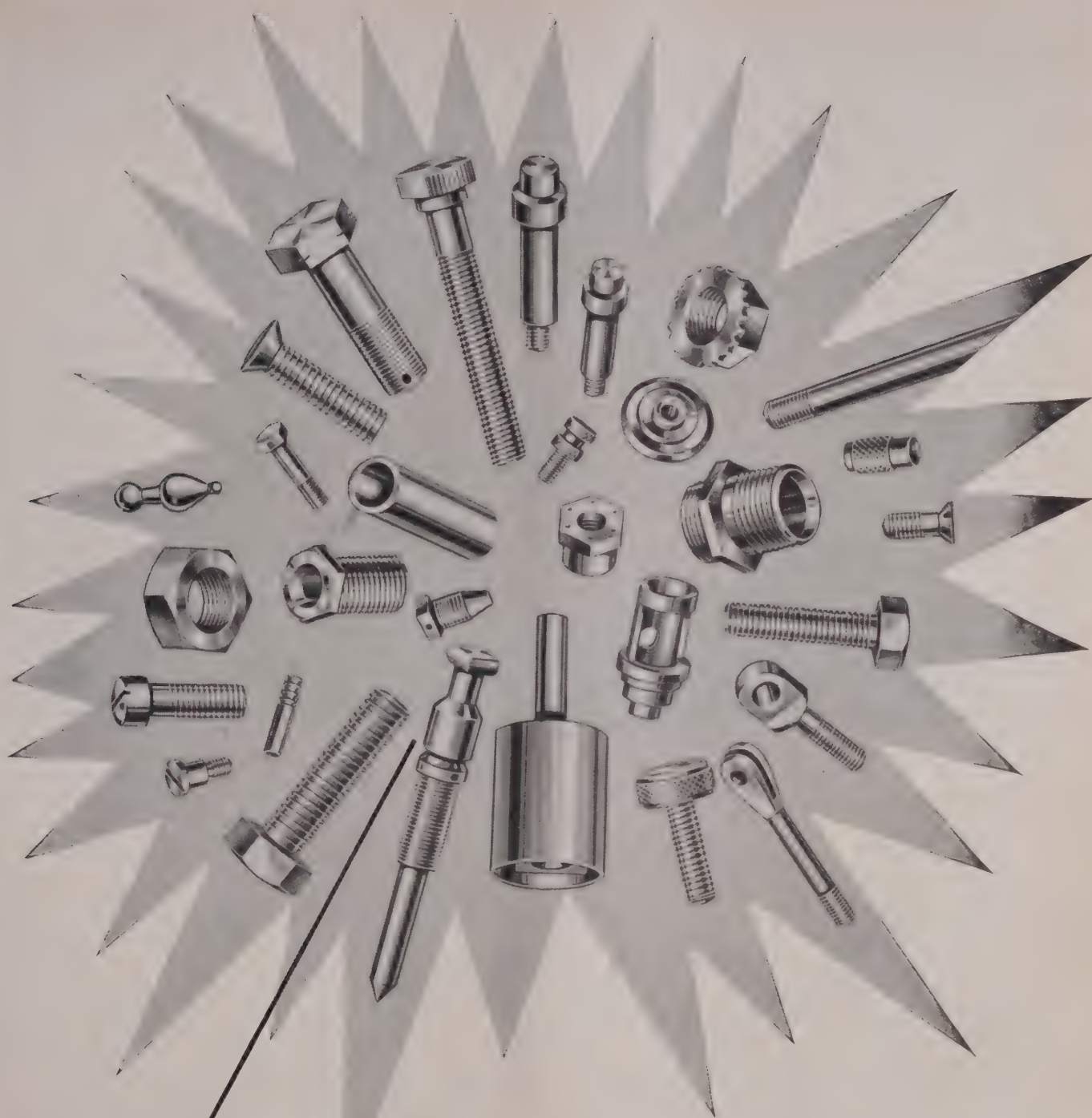
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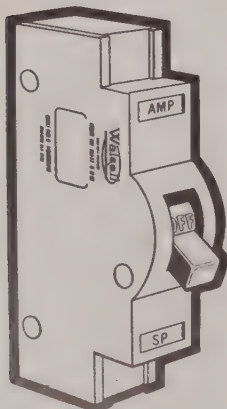
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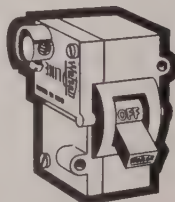
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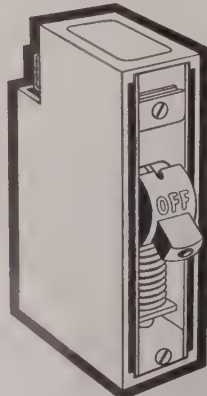




'S' RANGE



'W' RANGE



'A' RANGE

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MINIATURE  
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BREAKERS

## COMPLETE CONTROL

and protection of an electrical circuit is achieved by the use of miniature circuit breakers, ensuring safety in all situations.

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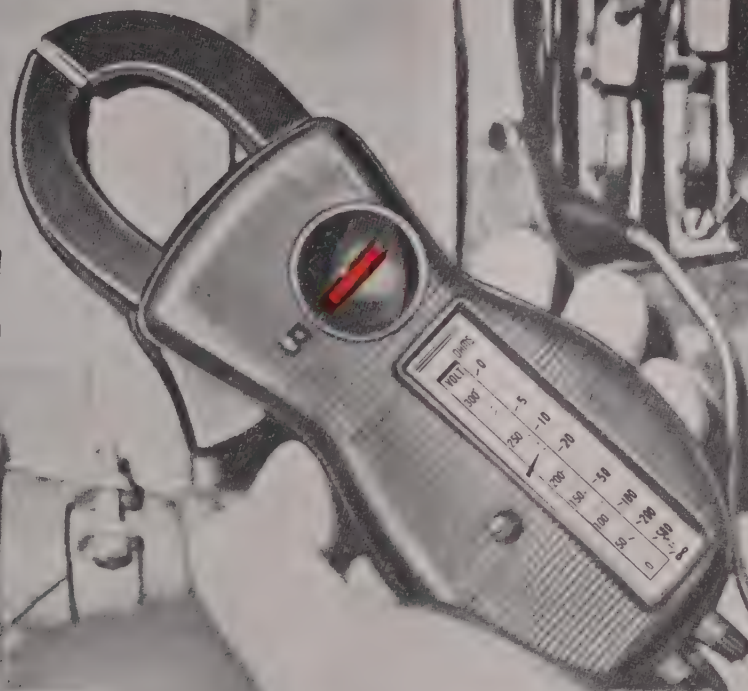
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**AS AN AMMETER:** snapped around conductors to balance circuits.



**AS AN OHMMETER:** check resistance of motor control solenoid coil.

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- Exclusive flat coil design
- Easiest to clean Radiant Hotplates ever made
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Only Vee-Line Radiant Hotplates give customers so many advantages. Years of trouble-free service. Longer, more efficient life. Superior English Electric quality. Once customers have cooked on a Vee-Line Hotplate, chances are they'll never be satisfied with other makes. Make sure you have ample stocks of Vee-Line Radiant Hotplates.

STOCK UP NOW! WRITE FOR FREE DISPLAY MATERIAL

## Vee-Line RADIANT HOTPLATE





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**DOBECKOT EPOXY RESIN**

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Those who appreciate the  
very best choose...

# GOLDEN Crompton

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1. More good will.
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NOTE: So great is our confidence that we seal each lamp in a plastic envelope. There is no need for testing before sale.





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. . . you can bend it without fear of fracture! Burn Conduit is made to a consistently high standard in light and heavy gauges and a complete range of diameters. No need to bend yourself double over delivery—it's made 'at the double' from wholesalers throughout the country!

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to B.S. 31**



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Smethwick, Birmingham  
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GB 60

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*... for special purposes*



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**D2—D6**  
inclusive



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D.2340	Vibration Switch	D3
C.940	Snap-action Mercury Limit Switch	D4
WV } WH }	Electric Furnace Door Switches	D5
C.4433	Duration Switch	D6

## Hendrey Relays

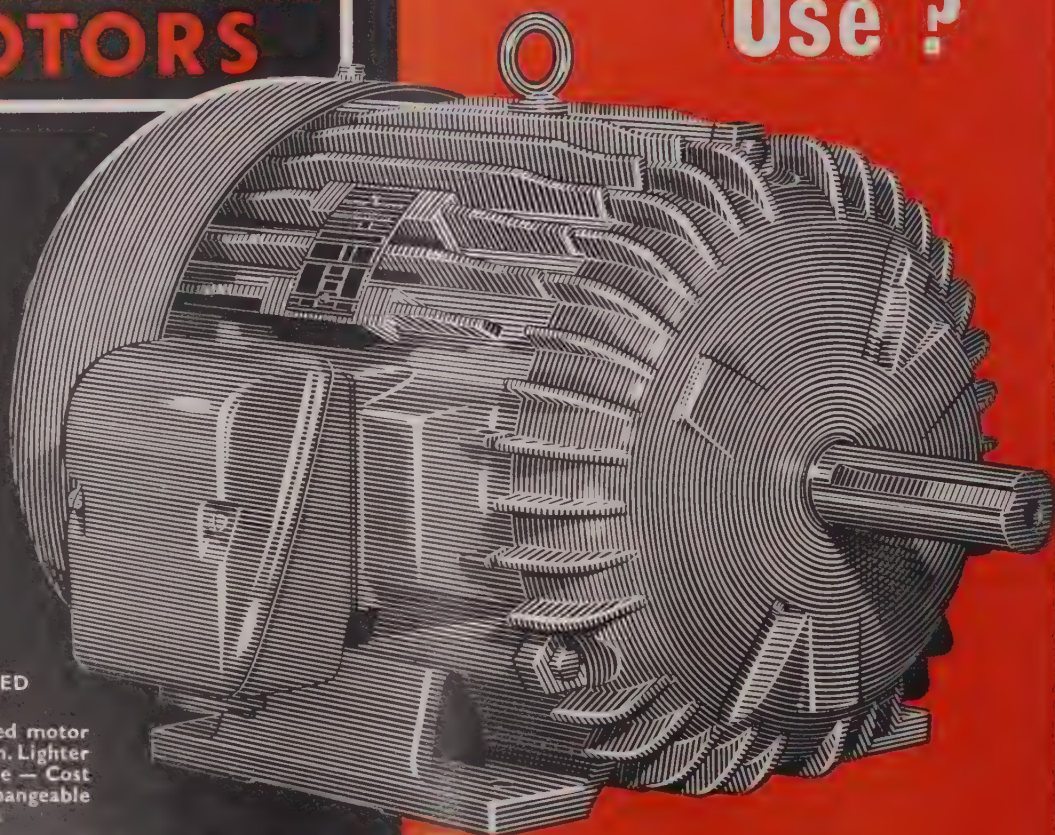
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POSITION .....

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# from 1/25th. to 600 horsepower

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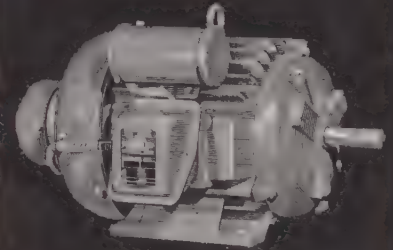
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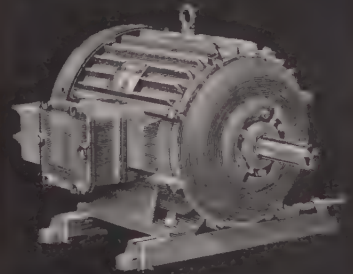
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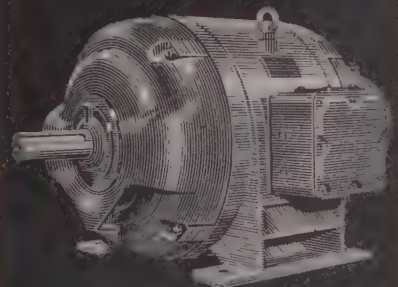
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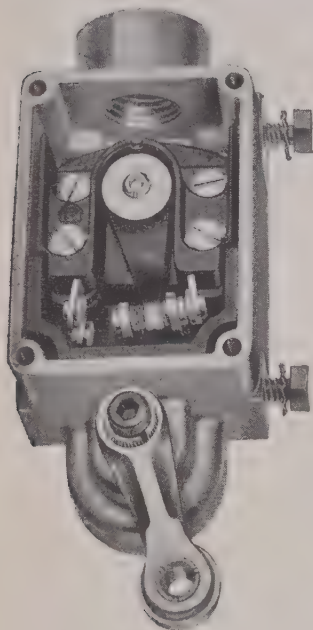
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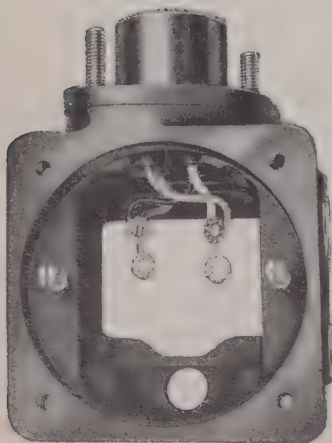




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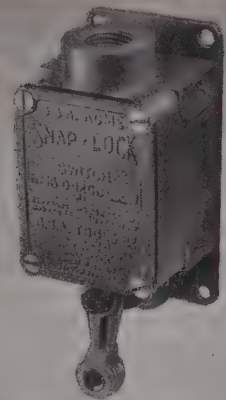
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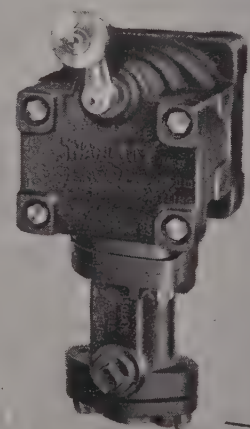


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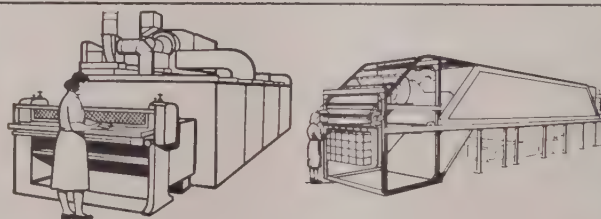
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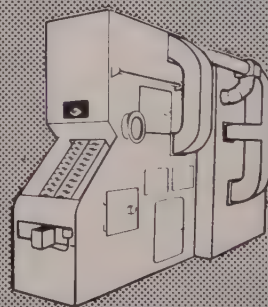
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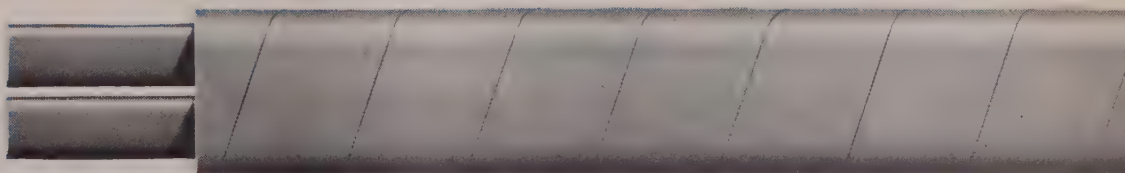


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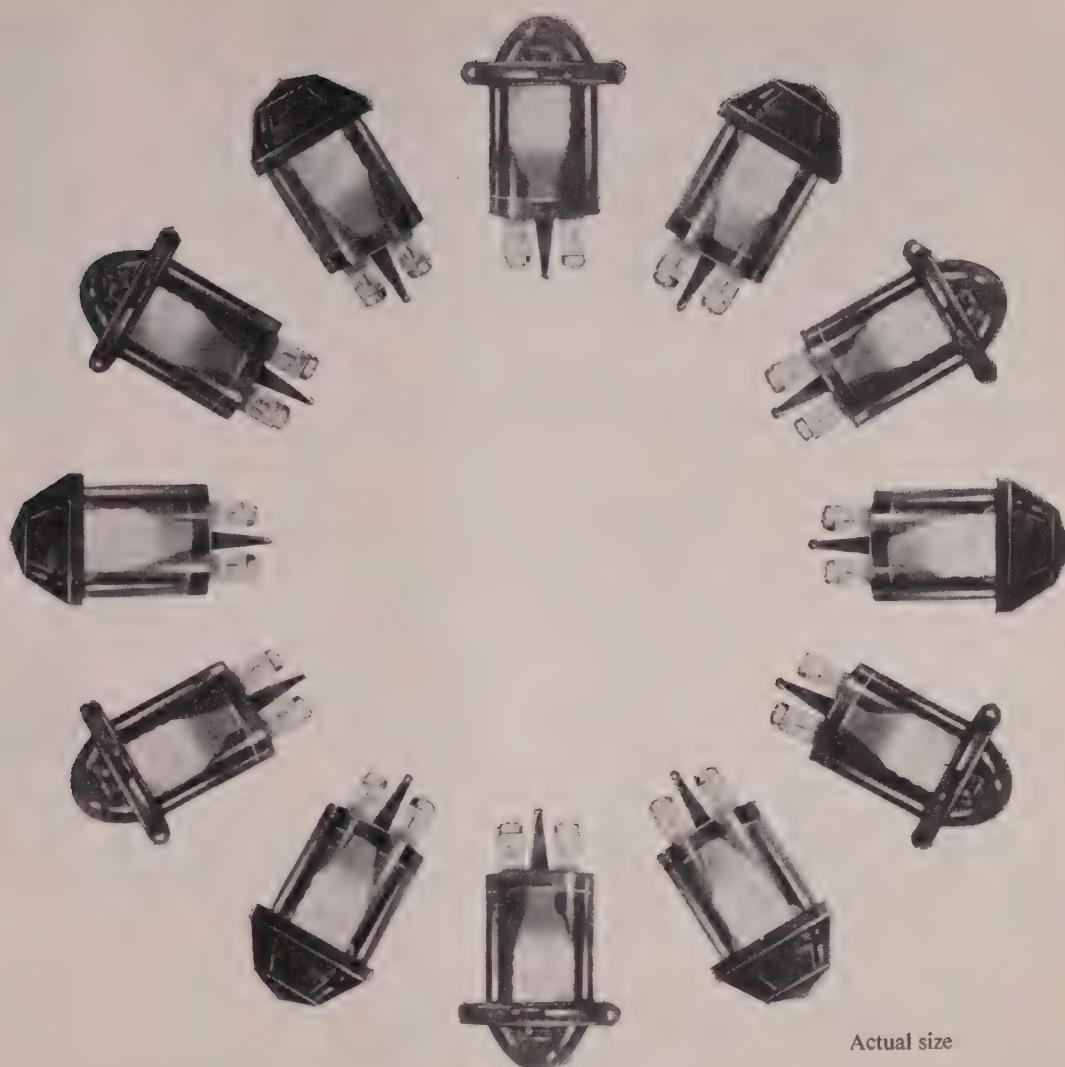
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# ELECTRICAL REVIEW

Friday 15 September 1961 Volume 169 No 11

## IN THIS ISSUE

### 413 Retail Revolution

Some of the changes taking place in retail distribution are discussed. It is pointed out that pricing in the supermarket has become an integral part of important new techniques of merchandising which enable the results of efficient retail management to be passed on to the consumer

### 415 House Service Meters

Production of single- and three-phase meters at the Enfield factory of Sangamo Weston, Ltd. Reference is made to some techniques which have been developed by the company

### 420 Farnborough Exhibits

Photographs of some of the more interesting items of electrical equipment shown at last week's exhibition organised by the Society of British Aircraft Constructors. A preview of the exhibition appeared in the 1st September issue of the *Electrical Review*

### 422 Energy Sources for Developing Countries

Report of a United Nations conference held in Rome during the last two weeks in August. Some 250 delegates from 71 countries attended the conference at which over 250 technical papers were presented

### 425 Permanent Magnets for Repulsion Systems

In this article by Dr. Malcolm McCaig a number of magnet systems are considered. Methods of estimating the repulsion force are suggested and the results compared with experimental determinations

### 443 Unconventional Energy Conversion Methods

Summary of papers of electrical interest presented at this year's meeting of the British Association for the Advancement of Science held at Norwich from 30th August to 6th September

## NEWS SECTIONS

429 Letters to the Editor

430 Nuclear Lubricants

431 Views on the News

433 Personal and Social

435 Industrial News

440 New Electrical Equipment

446 Financial Section

450 New Patents

451 Contract Information

452 Next Week's Events

99 CLASSIFIED ADVERTISEMENTS

110 INDEX TO ADVERTISERS

Supplement: Electric Blankets — Inside Back Cover

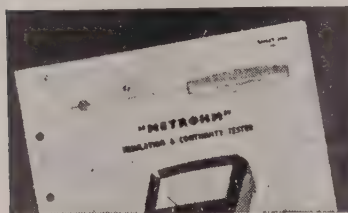


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# ELECTRICAL REVIEW

15 September 1961 Vol. 169 No. 11 Established 1872

## ***Retail Revolution***

**T**HE bright future consistently predicted for domestic appliance business is in marked contrast to the present situation which remains uncertain and often discouraging. Though well above the levels of a few years ago, sales advance erratically. Recently, domestic appliances have been taking a declining share of mounting consumer expenditure. At worst, in refrigerators, modern plant stands idle and workers are laid off. As production is cut back, unit costs rise and competition overseas is made more difficult. The direct cause is the Government's economic policies, which have hit domestic appliances unfairly, but a natural pre-occupation with the effect of these measures has unfortunately distracted attention from ways in which the industry itself might do more to boost sales.

Cut prices and discount trading are not temporary phenomena that will disappear with the return of more stable economic conditions; they are symptoms of a fundamental change in methods of distribution from which the electrical trade cannot isolate itself.

With the main emphasis in the past on developing methods of quantity production, the scope for economy and greater efficiency in distribution has received inadequate attention. But as Mr. Nicholas Stacey said in his paper to the British Association: "When many manufacturers are offering goods which are close substitutes for each other—in appearance, technical excellence, performance and price—the factors of business success lie in distribution, sales and marketing." In commending retail distribution "for innovation and imaginative ideas," it is significant that Mr. Stacey attributed much of the rapid progress in the grocery business to the decline of retail price maintenance. Nevertheless, he went on to point out that the objective of the retail revolution is "to reduce prices to the consumer by cutting the costs of distribution, yet disallowing any further erosion of the distributors' margins." Pricing in the supermarket has become an integral part of the important new techniques of merchandising which enable some of the results of efficient retail management to be passed on to the consumer.

In the electrical trade, recent concern with price cutting has overshadowed the importance of other aspects of selling. Yet the traditional



electrical retailer will maintain and improve his position only by exploiting his special advantages *vis-à-vis* the public and by improving the efficiency of his operations. The alternative is to see his business pass to those with more enterprise. The marked rise in the number of electrical retailers would seem to indicate that in the past profits have been obtained too easily.

With the development of independent servicing organisations, one important reason for dealing with an established retailer may disappear. But another, help in making a wise choice from the bewildering array of appliances now on the market, is of increasing importance. This involves more than price, as the consumer organisations have emphasised, and with their professional background the Area Boards and contractors have special opportunities and responsibilities in this direction. By exercising greater discrimination in their own purchases, and imagination in presentation, retailers would instil confidence in customers by indicating that they were prepared to back their own judgment. The higher levels of appliance ownership to which the industry aspires will not be achieved without major changes in methods of retail distribution.

### UNCONVENTIONAL ENERGY SOURCES

Though it may be true that a sound home market is an essential base for an expanding export trade, the conditions and attitudes of mind that determine the lines of technical development in Great Britain are not a sure guide when it comes to supplying the needs of less advanced countries. Even given favourable climatic conditions, the use of the sun and the wind as sources of power could only have very marginal applications in this country because of the almost universal availability of electricity from the grid.

This leads to the development of such unconventional sources of energy being regarded with some scepticism, not least because of their unreliability. But, as a correspondent points out in an article on page 422, this drawback is of little moment when the alternative is no power at all. Electricity is still only available to half the world's population and even in the more advanced of the under-developed countries, such as India, it will be at least 25 to 30 years before rural electrification by extension of the grid reaches completion. In the meantime, exploiting the energy of the wind and sun could offer an economical solution. The United Nations conference showed that useful progress is being made in developing solar and wind generators; the need is to expand their application.

### POWER AND WATER

One virtue of gatherings of the type held annually by the British Association is the opportunity readily provided for papers being presented in any session on a given subject to be prepared by authorities on all the aspects of the topic concerned. The audience attracted will also have a variety of interests in the

subject and this does much to increase the value of any ensuing discussion. One topic which was treated in this manner this year concerned power supplies and water resources. Speakers discussed the requirements of the supply industry of water for cooling or as hydro-power, the recreational uses of reservoirs, the biological effects of power station discharge water, and the reactions of fish to increased temperatures.

The final paper in the session dealt with the reservoir at Trawsfynydd, which offers considerable scope for scientific experiment and subsequently recreation. The reservoir was formed some 30 years ago for the 24 MW Maentwrog hydro-station and it is now to be used as a cooling pond for the 500 MW nuclear station. A flow of 800 million gallons daily will occur in the inlet and outlet channels, and it is thought that the water will circulate once a week. The conditions are eminently suitable for controlled experiments on cooling rates and on biological subjects. Since the scope for work on these is more than the Generating Board would be justified in undertaking, residential accommodation will be provided in a laboratory being built by the shore for scientists from other authorities. It is hoped that full advantage will be taken of the opportunity for research offered by these conditions and that what may well be regarded as a "classic" investigation will result. Eventually, the lake with its warmed waters could become a centre for aquatic sports and fishing.

### NUCLEAR POWER ECONOMICS

The General Electric Co. of America is now offering advanced boiling-water reactor power plants rated at up to 500 MW. It claims that these will produce electricity at a cost equal to conventional power stations in the higher fuel cost areas of the world. Although no supporting cost figures are given in the announcement, a report in the *Electrical World* of 21st August puts the capital cost of these plants at between £55/kW and £70/kW. However, B.W.R. systems require enriched fuel which reduces the economic advantage of low capital costs by increasing fuel costs as compared with the present British civil nuclear reactor systems.

The International Atomic Energy Agency has recently published a report which shows that if a 150-200 MW nuclear power plant (type not stated) is installed in the island of Luzon in the Philippines, it might be economically competitive over its lifetime with an oil-fired power station of the same size. The adoption of nuclear plant would also enable the Philippines to escape total dependence on a single fuel source, namely oil, with the added advantage that costs may be more stable than those of oil-fired plants, whose operating costs are affected by fluctuations in oil prices.

**Domestic Supplement – Electric Blankets –  
at the end of this issue**



# House Service Meters

LARGE-SCALE PRODUCTION BY SANGAMO WESTON

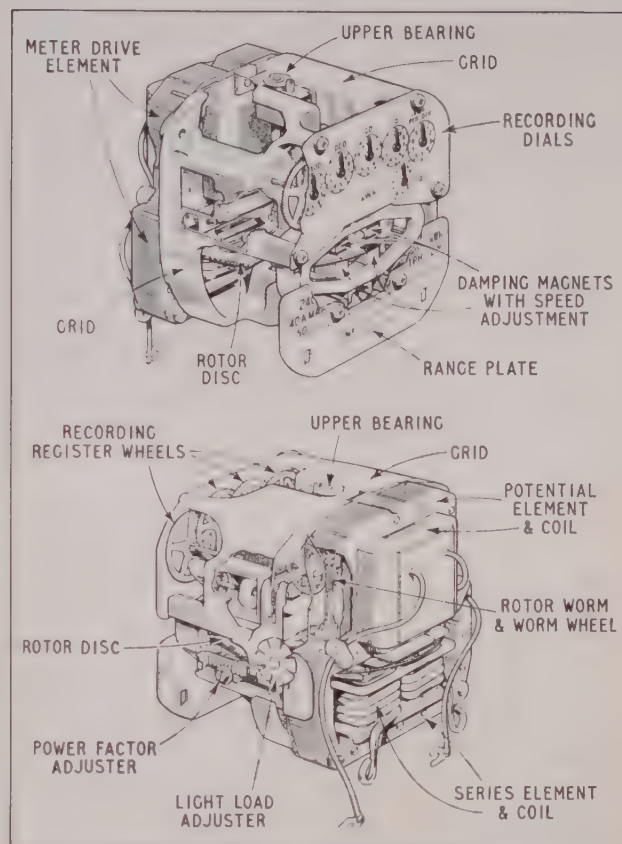
Single- and three-phase house service meters are manufactured by Sangamo Weston, Ltd., at Enfield, in a factory specifically laid out for this task. Their production is described in this article, reference being made to some techniques which have been developed by the company. Next week's issue will contain an article on calibration of these meters on specialised equipment

**T**HE history of the meter and instrument manufacturing company, Sangamo Weston, Ltd., dates back to 1920 when the British Sangamo Co., Ltd., was formed with production facilities in a section of the works of the Edison Swan Electric Co., Ltd., Ponders End. In 1929 the company moved to the site of the present factory in Great Cambridge Road, Enfield, and the production of meters and time switches was expanded. Just before the last war, the Weston Electric Instrument Company of Surbiton was acquired. A new meter, known as the Model S.200, was designed to meet the modern demands for improved performance, and the opportunity was taken to construct a new factory, having a floor area of some 65,000 sq ft, laid out specifically for meter production using a flow line principle. This factory has double glazed windows and a dust-free temperature controlled atmosphere, being ventilated on the plenum system. The equipment incorporated includes machinery utilising a number of new techniques which have been developed for meter production, including coil wrapping, core lacing, gear train checking, and automatically recording meter test equipment. Other products made by Sangamo Weston include time switches, laboratory type measuring instruments, aircraft instruments, temperature measuring instruments, thermocouples and resistance bulbs, and photographic exposure meters.

Recently we visited the factory to see the production of single-phase house service meters. The ranges include all those required by the current British Standards Specification and the special range requirements for the export market.

## Component Production

All of the major components incorporated in these meters, with the exception of the magnets and jewels for the rotor bearings, are manufactured in the factory. Raw materials for these are tested before being passed for use on the manufacturing lines to ensure compliance with relevant British Standards or given more rigorous tests where these are demanded by the conditions of duty of a particular component. These initial tests cover electrical, magnetic and mechanical properties in addition to purity. Certain tolerances are permitted in the material characteristics, provided that they still remain within the



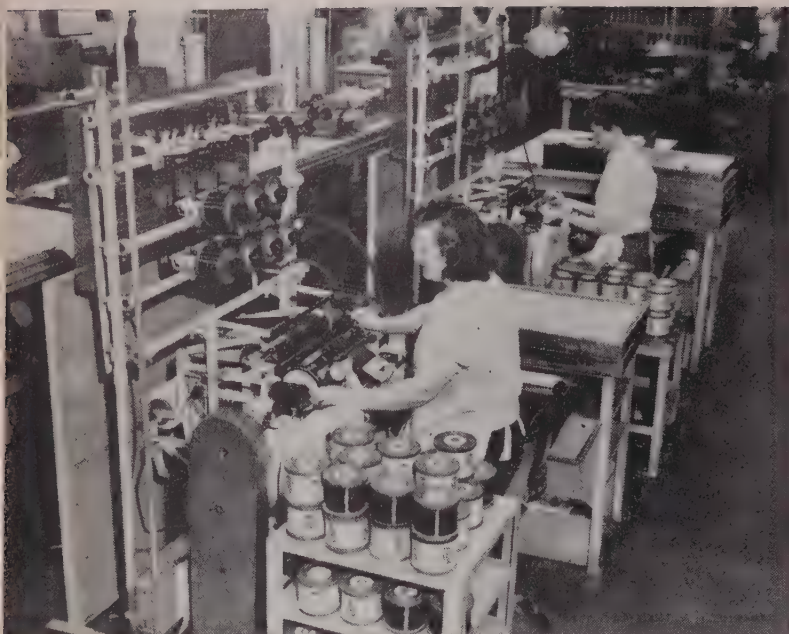
Sectional view of a single-phase meter, showing the principal components

specification limits, as allowance for these variations may be provided within the instrument in the form of compensating components.

The main frame of the mechanism is known as the "grid," and is an aluminium diecasting produced on a two-impression tool in a Lester machine. Two grids are produced with this tool at each charge of the machine, which can operate at up to 30 shots per hour. The material used is a 13 per cent aluminium/silicon alloy. When removed from the die, the two grids are still attached to the stalk; the slug, gates and the grids are cropped off in a press and the remaining material is returned for re-use. The grids are then sand blasted to remove the fine flash, fettled, and given two coats of protective lacquer. This lacquer contains a small percentage of molybdenum disulphide which enters the bearing holes to provide a dry lubricant.

Although of a very complex shape, no machining operations are performed on the grid. During later stages of assembly self-tapping screws are used and the bearings are retained by a spring clip device. In the top bearing the compression of a preformed spring by an adjusting screw causes a face on the spring to deflect and force the bearing into a vee-shaped indentation in the moulding, so gripping





Seven potential coils are wound simultaneously on each Leeson machine

the bearing. The lower bearing is of similar construction, except that in place of the vee-shaped indentation there is a semicircular recess with a cast thread. The bearing at this end has a matching thread and a slotted head, enabling the bearing height to be adjusted.

Another moulding operation is carried out in the production of the bakelite cases. These are compression moulded in pairs and in the moulding process a number of components are built in. These include the connecting terminal posts, the independent potential link which can be used to isolate the current and potential circuits during testing, and the cover and grid inserts.

Hot rolled silicon iron sheet for the potential element laminations is slit into appropriate widths in the raw material stores before the laminations are blanked on C.V.A. dieing presses. The laminations are then taken to a Hiton hydraulic assembly press, where they are weighed into groups corresponding to each core. This ensures that individual cores have sufficient iron to prevent operation at an excessive flux density. Laminations for the series yoke are also stamped from sheet material in the factory. In this only the yoke iron is weighed to ensure the right amount being present. The mounting strap is then riveted to the yoke and aluminium spray painted.

The series coil is wound with round copper wire covered with "Polyanite" enamel, which has a vinyl acetate base. The coil is then folded about its mid-point, effectively producing two adjacent coils of half the number of turns and joined at one end, and the end leads are formed and looped automatically by pneumatic tools.

### Potential Element Assembly

In the separate section laid out for assembling the potential elements, seven potential coils are wound simultaneously on a former on each Leeson winding machine. A single sheet of insulating paper is automatically inserted and wrapped round the seven coils at the completion of each layer of the winding. When each group of coils has been completely wound the individual coils are



While the potential coils are being wrapped with polythene coated paper, the leads are attached to the ends of the winding

separated by cutting the insulation while the coils are still on the former of the winding machine. The coils are then wrapped with polythene coated paper and during this operation the leads are attached to the ends of the winding. Tests are then made to ensure that each coil has the correct number of turns and insulation.

The potential core laminations are threaded into the coil in a specially developed machine. A pack of laminations of the correct thickness for the coil being used is placed in the machine together with the coil. Each lamination is taken from the pile by a pneumatic pick-off device and fed into the coil by a moving arm. The limbs of the lamination are deflected by guides as the lamination is forced into the coil, facilitating entry. The core and lamination assembly is then fed by a chute to a moulding machine in which a polythene covering is moulded over the coil. The assembly is then transferred to a Hiton press and the first riveting operation carried out. This rivets the main core laminations together and fixes the top mounting strap. Before the second operation, in which the light load adjustment bracket and the location plate are riveted on, the assembly is aluminium spray painted. Finally the phase band, which provides magnetic flux phase compensation, is riveted to the main core together with a magnetic shunt assembly for controlling the meter performance. The potential element is then fitted with the light load vane and adjusting screw. This vane is moved laterally to give adjustment by a capstan screw, which is spring loaded to give stability and prevent accidental movement after final calibration.

The braking magnet unit comprises a mild steel saddle, blanked and formed on power presses, to which four anisotropic "Alcomax" magnets are attached, using a Radyne induction heating soldering machine. A solder paste is applied to the magnets and the parts are assembled in two jigs which are fitted into a turret head. This head rotates two assemblies at a time into position under the heating coils. As the turret indexes, these assemblies are cooled and automatically ejected. Before being passed to



the paint shop, where a hammer finished aluminium paint is applied, the saddle and the assembly complete with its magnets are checked for mechanical strength and gap accuracy. After painting the assembly is fitted with a magnetic shunt for feed adjustment. This is in the form of a brass screw which moves a steel disc between one pair of magnets towards or away from the disc of the instrument itself and has the effect of varying the damping. Temperature compensation is provided by a fixed shunt of temperature sensitive magnetic material fitted between the other pair of magnets.

### Rotor System

The disc is blanked from pure iron-free aluminium. During blanking and all subsequent operations care is taken to protect the disc from contamination, particularly from iron dust. The discs are then treated to remove any stresses in the material and flattened by clamping them in jigs and heating slightly. To ensure a true edge the discs are then chamfered in a press tool. This production method ensures a perfectly flat disc and this has enabled stippling to be eliminated from the disc which now has bright, smooth surfaces. The discs are then delivered to a final assembly shop where the calibration lines for use during speed checking and the matt black segment on the underside of the disc for use in conjunction with photocell type recorders, are silk screen printed.

The disc is fitted on to its spindle in a Fisher diecasting machine. This injects the materials for the hub between the disc and the spindle in a molten state. The disc spindles are machined from duralumin rod which has first been centreless ground on Petermann automatic lathes. A second operation is performed to drill and counterbore

one end and the worm is then cut on a Mikron thread milling machine.

All the spindles for the gear train are produced on Petermann automatic lathes. The gears themselves are cut on Mikron automatic gear hobbing machines, except for the 100-tooth wheels, which are blanked complete with teeth on power presses by compound tools. This ensures that every wheel has the exact number of teeth.

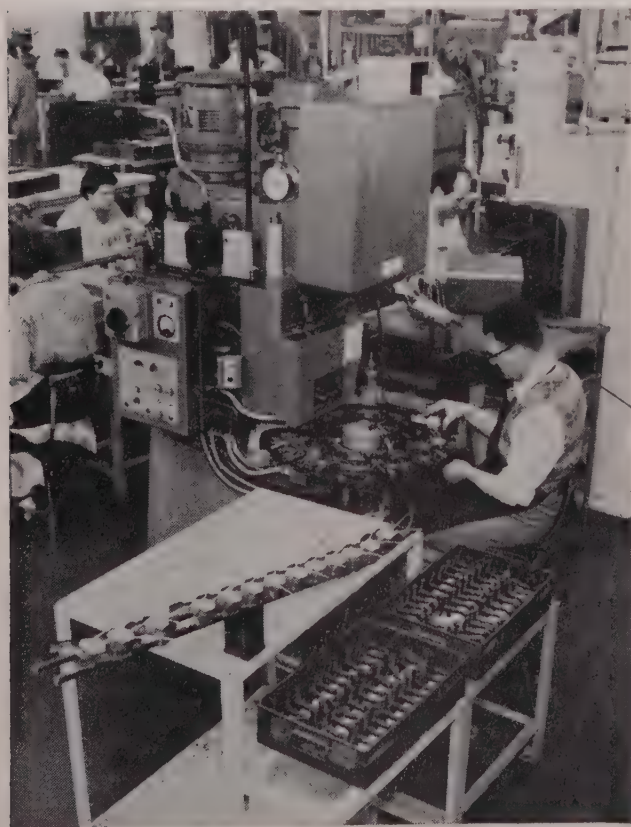
The upper bearing housing is turned from duralumin on automatic screw cutting machines and consists of a tube with a locating disc on one end. The pivot is fitted into this using a bismuth based solder on an induction heating machine. The pivots are made from Cobenium chrome based stainless steel. The duralumin lower bearing is also turned on automatic screw-cutting machines and the sapphire bearing jewel is fitted into the screw and subjected to microscopic examination and steam cleaning.

A new type of bearing has recently been introduced based on magnetic flotation of the rotor. This has eliminated the use of the double jewel and ball bearing which has been replaced by upper and lower pintles in diecast housings operating into carbon ring jewels placed at each end of the rotor spindle. Flotation of the rotor is obtained by the repulsive force between two small barium-oxide magnets, one of which is attached to the underside of the rotor and the other fitted into a moulded housing attached to the lower bearing. Adjustment of disc position is made by rotating the fixed magnet on a threaded portion of the lower bearing housing. It is claimed that this type of bearing will give much longer useful life in service without maintenance since the high intrinsic pressures between pivot and jewel inherent in the conventional bearing have been eliminated. The use of corrosion proof pintles operating in carbon bearings eliminates the need for wet lubricants.

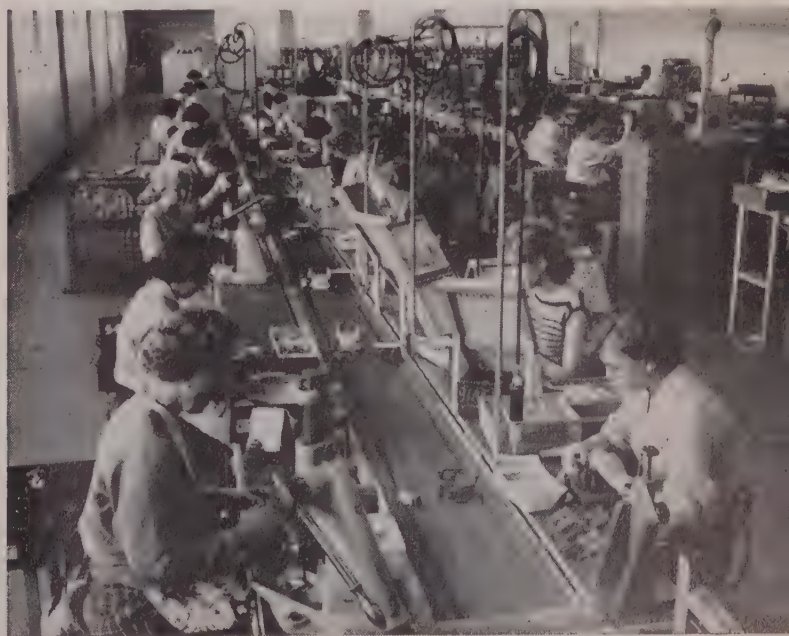
### Final Assembly

The components are taken through the final assembly area on a conveyor belt, on both sides of which the various assembling operations are carried out. On one side the

*Final assembly is carried out on both sides of this conveyor, the grid, the recording gear train and rotor being dealt with on the left and the series and potential elements on the right*



*A polythene covering is moulded over the potential coil after threading of the core laminations has been carried out*





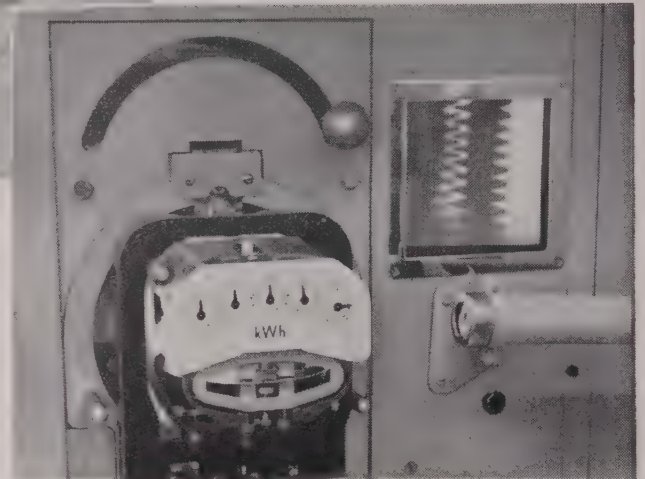


After zero power factor and potential creep checking and preliminary calibration with inductive and light loads, the magnet assembly is completed and a preliminary calibration is made on full load on the benches in the foreground. A shadowgraph is incorporated in these benches, shown on the right, enabling the meshing of the meter worm and train register worm wheel to be adjusted

grid is assembled with the recording gear train, bearings and rotor system. The depth of meshing of the rotor spindle and worm wheel is checked and adjusted on a shadowgraph. Before each gear train is assembled with the rotor a check is carried out to ensure that the gear register ratios are correct. The hands are fixed on the spindles, using a template to ensure that they are in a set position indicating a given number of revolutions. The assembly is then put on to a ratio checker which drives the worm wheel the preset number of revolutions, controlled by an automatic switch. If the ratios are correct all the hands read zero. The rotor spindle is fitted with bearing caps, assembled to the grid with bearing screws, and adjusted for end shake and tooth engagement.

On the other side of the conveyor, the series coil is fitted to the series yoke with the power factor compensating coil which provides finely variable phase compensation of the magnetic flux in the electromagnet gap by an adjustable slide wire connected to the coil. Coil insulators and the overload bridge are also fitted at this stage, and the series element and potential element are then assembled. Tight location of the joints between the cores of the elements ensures consistent assembly, and stability is provided by a strong strap bonding the two elements together.

This assembly is now fitted on to the base of the bakelite casing, the series coil and potential leads being attached to the appropriate terminals. Up to this point the grid assembly and electromagnet assembly have been proceeding along the conveyor belt together and the grid with disc

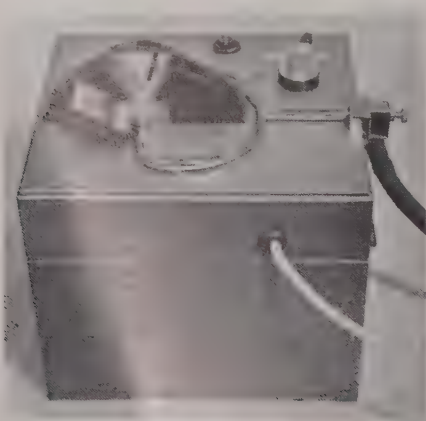


is now assembled on to the electromagnet assembly in the case and secured to the base by three nuts. The assembly is then vacuum cleaned and the meter is placed on a precalibration test bench.

### Precalibration

There are two stages of precalibration. In the first, meters which have no brake magnets are received from the final assembly line and placed on a special test bench. With a voltage applied to the potential circuit only, the light load adjuster is set to give balanced forward and backward movement of the disc at the anti-creep holes. Since there is no magnet damping at this stage, the test is very sensitive and the adjustment brings the subsequent accuracy on light load to within  $\pm 2$  per cent. Full load current is then applied at rated voltage and zero power factor and this condition is maintained automatically while the meter is being adjusted. The master meter contains a disc with a shaped periphery, over which a small induction coil is suspended, connected to the tuned grid circuit of an oscillator. Any movement of the disc with respect to the coil changes the grid tuning and causes a variation in the current in the anode circuit of the oscillator, which is connected to the d.c. control winding of a saturable reactor. The a.c. winding of the reactor is connected to a phase shifting network which is associated with the master meter potential coil. Thus any change in the phase angle between full load current and rated voltage in the meter circuit will cause the shaped disc of the master meter to rotate. This affects the tuning of the oscillator and causes a variation in anode current, which in turn alters the impedance of the saturable reactor. This reacts on the phase shifting network which balances the voltage supply to the master meter and the meter under calibration and automatically restores the condition of  $90^\circ$  with respect to the load current without hunting, since no mechanical device is used.

The inductive load adjuster on the meter under test is



Care is taken to ensure that the flat, smooth discs are free from contamination, particularly iron dust, before final assembly



then set to give a standstill condition of the disc and the subsequent accuracy of the meter on 0.5 power factor load when transferred to the final calibration equipment is generally within  $\pm 1$  per cent. An oscilloscope indicates the correctness of the meter assembly by showing a straight line trace. In the case of a faulty assembly, a Lissajous figure is produced on the oscilloscope screen, the shape of which indicates the nature of the fault.

Before the magnets are fitted into the final assembly the magnet sub-assembly is magnetised. This is achieved by inserting a bar into the sub-assembly and passing through this a heavy current pulse obtained from a capacitor triggered from an ignitron circuit. The magnet units are then artificially aged in an alternating field to a prescribed amount, and stabilised by a period of baking in an oven. The units are then stored in special covered boxes until they are required for installing in the meter. After the brake magnets have been fitted the second stage of pre-

calibration is carried out, the meter being adjusted to within  $\pm 1$  per cent on full load at unity power factor using a conventional stroboscope test. A second shadowgraph giving an enlarged view of the meter worm and train register worm wheel meshing is used, so that mechanical adjustment and trueness of rotation of the rotor may be checked accurately under full load conditions. The meters are then transferred to another bench where they are tested for at least one complete disc revolution at approximately 80 per cent of the nominal minimum operating load which is equivalent to 0.2 per cent of the rated capacity of the meter.

The meters are then conveyed to special equipment which has been developed by the company for final accurate calibration. Four sets of this equipment have been installed, each capable of dealing simultaneously with 50 meters. An article illustrating and describing this equipment will be published in next week's issue.

## ELECTRICAL DEVELOPMENT IN SOUTH AFRICA

THE pace of electrification in South Africa is shown by the fact that, in the past decade, the installed capacity of the Electricity Supply Commission's power stations has more than doubled. At the end of March last the aggregate figure was 3,479 MW and a further 1,265 MW of generating plant was under construction or on order. During the same ten years electricity consumption rose at an average annual rate of 8.8 per cent (last year the gain was 9.3 per cent). The Commission's revenue has increased from R19 million\* in 1951 to R81.8 million last year and the total capital investment in power stations and transmission and distribution systems has amounted to R376.3 million, of which R69.2 million was borrowed overseas. Revenue in 1960 was 12.1 per cent more than in the previous year. Production costs rose by 12.2 per cent, a lower rate than in 1959.

The Commission's annual report shows that the mining industry took half of the 16,094 million kWh sold last year. Substantial development is also taking place in electric traction. The length of electrified track of South African Railways is now 2,868 miles, nearly 15 per cent of the total rail network. For the electrification of the main line between Touws River and Beaufort West eight of the twelve traction substations in the Commission's Cape Western Undertaking were completed in 1960.

In the Eastern Transvaal Undertaking the first boiler and turbo-generator of Komati power station are expected to be in service by the end of this year, followed by the second set and boiler at the beginning of 1962. The extension from Komati to Machadodorp and thence to Penge marks a first step towards major developments in the Eastern Transvaal Lowveld. Bulk supplies to Belfast and Machadodorp were commenced early in 1960 and contracts were negotiated to provide bulk supplies to the municipalities of Nelspruit, White River and Barberton.

The Highveld power station in the Rand and Orange Free State Undertaking, which was started up in 1959, now has an installed capacity of 360 MW with the commission-

ing of two further turbo-generators and boilers. Towards the end of 1960 the decision was taken to order two more 60 MW sets with corresponding boiler plant for commissioning in 1963. A second 100 MW turbo-generator and boiler were ordered during the year for the Ingagane power station in Natal.

An additional 623 farms were supplied with electricity in Escom's programme of rural electrification. This brings the total number of farms supplied in the past three years to 1,688. At an average cost of R2,000 per farm, this represents a capital investment of R3 million. A great deal of work was done last year in the development of demand meters and circuit-breakers suitable for the small power supplies characteristic of rural areas.

## Switchgear Connection Marking

A revision of the 1938 edition of B.S. 158 has simplified the future marking and arrangement of switchgear busbars, main connections and small wiring. The colours now prescribed do not involve stripes, and white is no longer included as an alternative to yellow for polyphase markings. Colours for main connections and small wiring have been brought closely into line and the roles played by green and black are different in the new edition, green denoting earth connections and black is used for neutral conductors.

The new requirements will call for changes in the British Standards for electric cables, and the current Regulations for the Electrical Equipment of Buildings (published by the Institution of Electrical Engineers). Amendments to these British Standards and to the Regulations are under consideration with a view to achieving close alignment of identification colours. An appendix to the revised specification gives guidance on the marking of small wiring and includes reference to one system in which each wire is given a letter to denote its function and a suffix number to identify the individual wire.

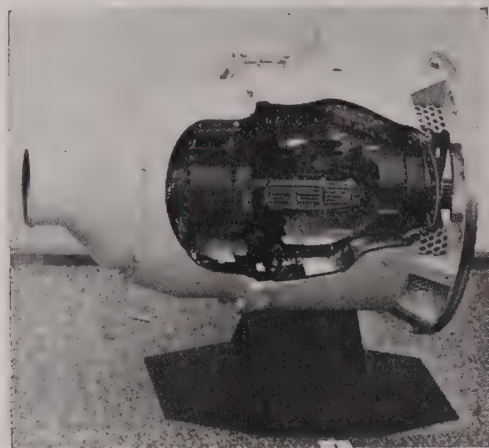
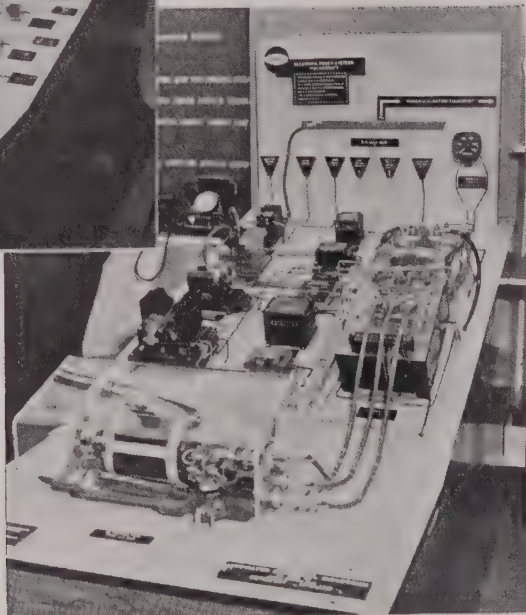
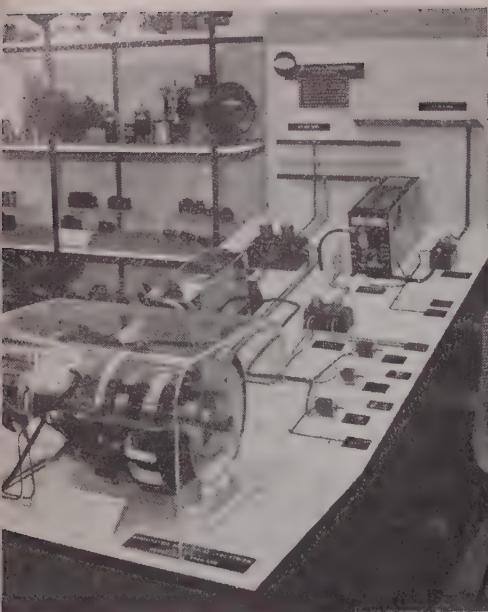
Copies may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1, price 5s.

\* Rand = 10s.

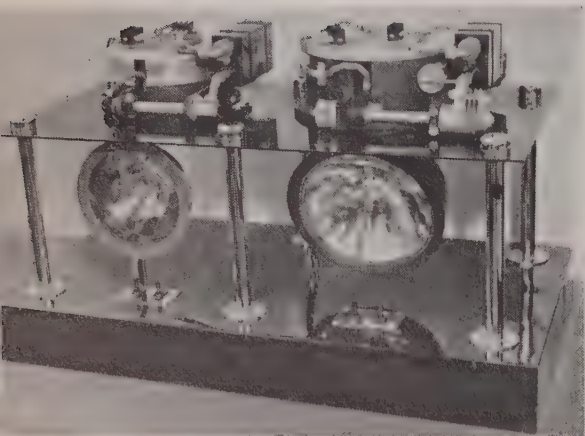


# FARNBOROUGH

◀ Typical a.c. and d.c. aircraft power systems could be compared on the A.E.I. stand. The constant frequency a.c. system shown above comprises a 40 kVA 200 V three-phase 400 c/s brushless alternator and its associated control units for regulation and fault protection. A supply is also taken through a 3 kW transformer/rectifier unit to the 28 V d.c. busbar. Below is shown a system for aircraft whose main power circuit is at 28 V d.c. A 14½ kVA frequency-wild alternator supplies the busbar through silicon rectifiers



▲ Brushless generator rated at 40 kVA 120/208 V three-phase 400 c/s manufactured by the Plessey Co., Ltd., under licence from the Westinghouse Electric Corporation of the U.S.A. for the a.c. system to be incorporated in the Vickers VC10 airliner

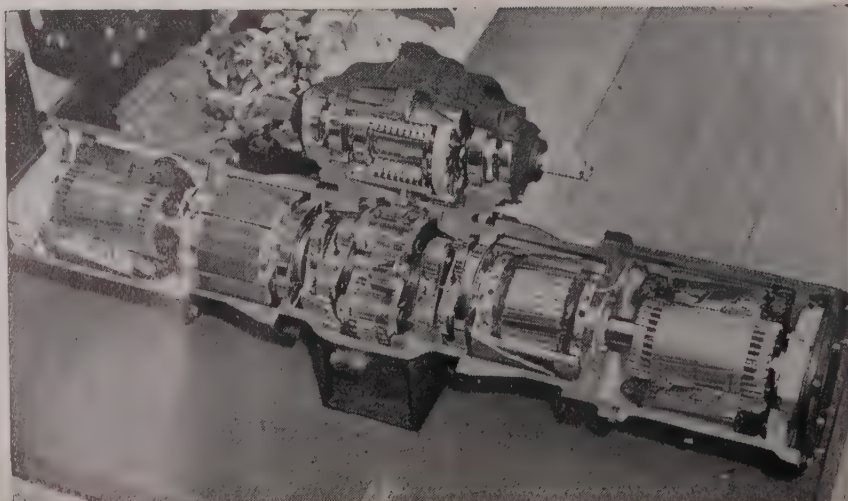


▲ New aircraft landing and taxiing lamps shown by Harley Aircraft Landing Lamps. Left is a prototype fully retractable light-weight unit for helicopter use. This is fitted with a 28 V 144 W double filament bulb and weighs under 6 lb. The lamp on the right incorporates an A.E.I. 28 V sealed beam unit with a 400 W filament for taxiing to which is added a 600 W filament for landing. Provision is made for the lamp to retract automatically if the aircraft speed exceeds 145 knots

▶ Large scale model of a Collecon 26-way connector shown by Belling & Lee, Ltd. In this type of connector every pin is individually locked into its mating socket



▶ Rotax actuator used for tailplane operation in the Avro Vulcan B.2. Two 6 h.p. motors supplied at 200 V three-phase 400 c/s are incorporated and the output shaft has a torque of 200 lb-ft at 370 r.p.m.

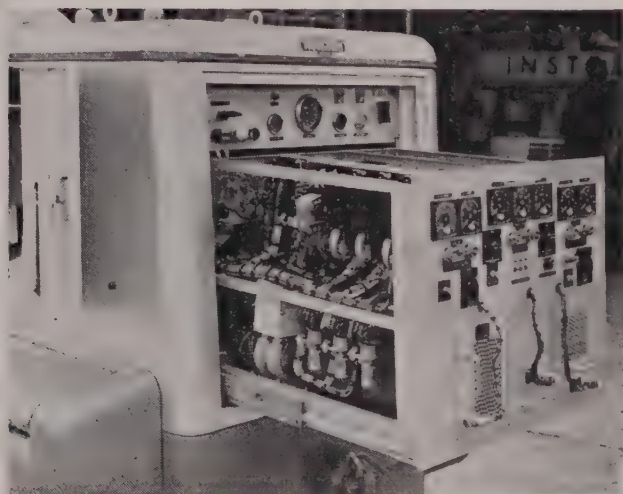
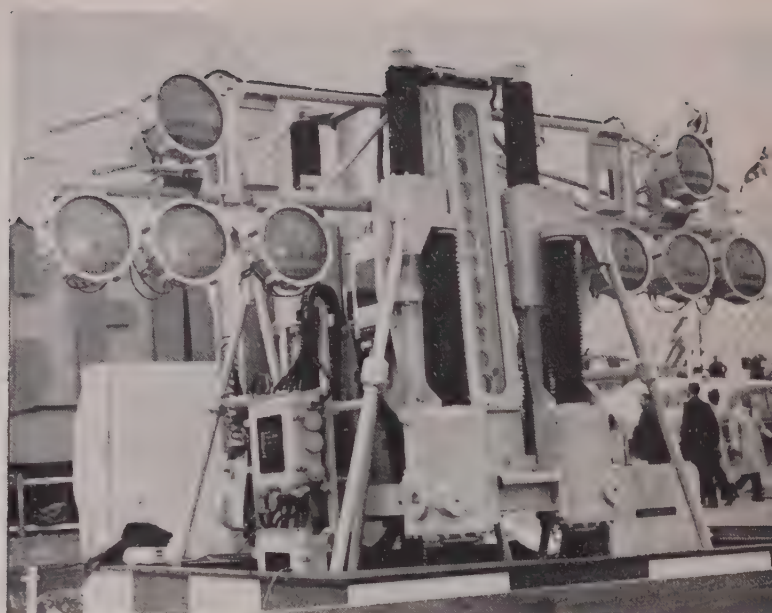




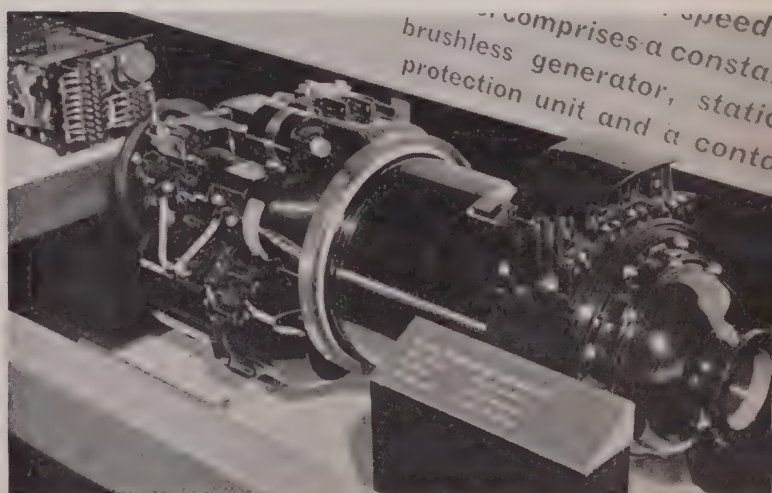
# EXHIBITS

## Some of the Electrical Equipment on View at Last Week's S.B.A.C. Show

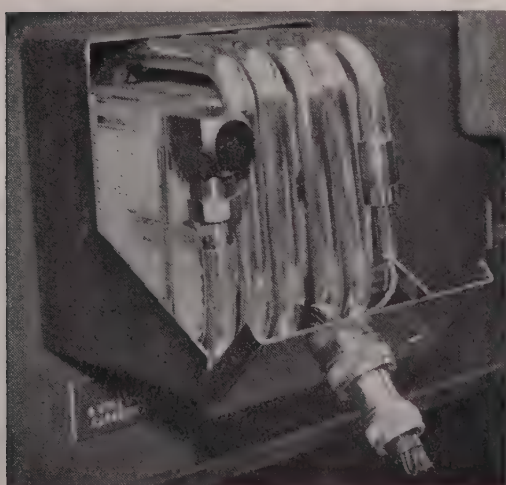
▶ New deck landing projector sight developed by the General Electric Co., Ltd., in conjunction with the Admiralty. The twelve vertical lamps have orange coloured beams. On each side of these are three green lights which form a datum and above these are two red lights used to indicate if the flight deck is not clear for landing. The sight has a useful range of  $1\frac{1}{2}$  miles and at 400ft a pilot can detect an error of one foot from the correct glide path



▲ The control panel of this Houchin ground power unit can be extended for maintenance or adjustment. The unit has outputs of 75 kVA 200 V three-phase 400 c/s from unity to 0.8 lagging power factor; 300 A continuously or 900 A intermittently at 112 V d.c.; and 1,200 A continuously or 2,500 A intermittently at 28.5 V d.c. The total peak output is 120 kW

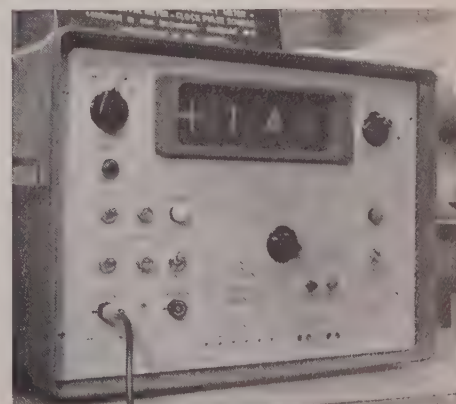


▲ Constant frequency system as shown by English Electric. The brushless alternator is rated at 30kVA at 0.9 p.f. 200V three-phase 400 c/s. The 38 h.p. Sundstrand drive has input speeds of between 3,100 and 7,950 r.p.m. and an output speed of 8,000 r.p.m.



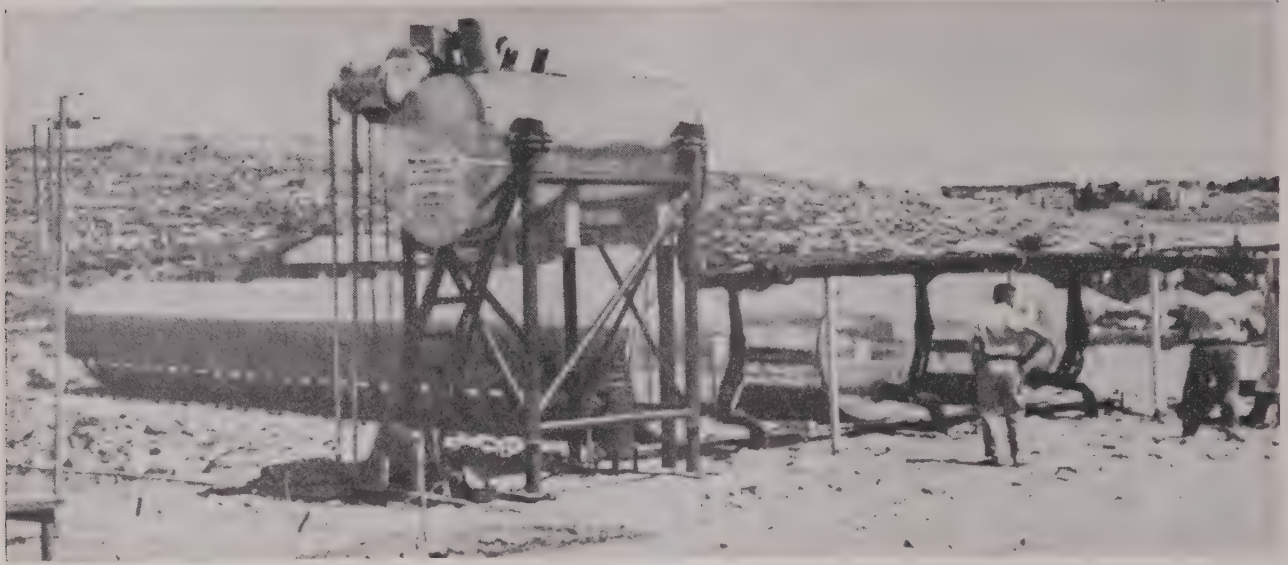
◀ A series of silver oxide/zinc batteries has been developed by Joseph Lucas, Ltd., for applications requiring high power/weight and power/volume ratios. This 6 V single-shot battery has a capacity of 7 Ah

▶ A digital voltmeter counter shown by Southern Instruments, Ltd.





# ENERGY SOURCES FOR DEVELOPING COUNTRIES



Solar power unit of 5 h.p. rating developed by the National Physical Laboratory of Israel

## United Nations Conference in Rome

### FROM A SPECIAL CORRESPONDENT

**P**ROBABLY more than half of the present world population of nearly 3,000 million people have no electricity at all, while many more have inadequate or very expensive supplies. Yet no significant improvement in their present low standard of living can be achieved without the aid of energy to assist human and animal labour in the most common activity of the underdeveloped—or “developing”—areas which is agriculture. To discuss the energy problems of these areas and, if possible, to determine how the technologies of the more advanced countries can best be applied to help the less fortunate peoples of the world to obtain more power aid, a United Nations conference on “New Sources of Energy” was held in Rome during the last two weeks of August. It was attended by some 500 delegates from 71 countries and there were over 250 technical papers on various aspects of the development and use of the three energy sources, wind, solar radiation and geothermal heat.

To appreciate the need for a conference of this kind it is only necessary to glance at the present world situation in energy consumption. Taking all sources of energy, including the so-called non-commercial sources (mainly wood and agricultural wastes which still constitute more than half, sometimes over three-quarters, of the energy consumption in countries of Africa, Asia and Latin America), the annual *per capita* consumption is about 1.6 tons of coal equivalent. This consumption is very unequal: the advanced industrialised countries have 30 per cent of the world population but consume 84 per cent of the energy. The more backward countries, with 20 per cent of the world population, use only 1 per cent of the energy. In the U.S.A. the figure is over 8 tons per head, while in many of the under-developed countries it is

less than 0.5 ton. This lack of energy is reflected in the annual *per capita* income: this exceeds 1,000 U.S. dollars for most of the countries with a *per capita* energy consumption of 4 tons or more and is less than 100 dollars for those with the lowest consumptions. Whether these small incomes are the cause of, or the effect of, low energy use it is difficult to say, but certainly the two are inter-related.

Although these consumption figures refer to total energy, the same argument applies to electrical energy alone. The reasons for this position are certainly complex: many factors, climatic, political, and sociological are involved. But there is no doubt that an important contributory cause of the lack of rural electrification—which underlies the low *per capita* consumption because so many of the under-developed countries have large agricultural populations—is the heavy cost of transmission and distribution for relatively small individual loads to serve scattered villages and settlements in up-country areas. Local power stations, driven by diesel engines or gas turbines, do not solve the problem because of the high costs of transport for the fuel and the difficulty of providing adequate servicing and maintenance.

One can divide the areas in many under-developed countries—none of which either has a nation-wide grid at present or has any immediate prospect of having one—into three categories—(i) those in which some interconnection of power stations exists; (ii) areas in which there are small power stations (of a few hundred kW capacity) supplying the larger villages, and (iii) those areas remote from sources of power, either through distance or inaccessibility by regular transport, in which there is no electricity.

The areas in the first category have no need for the



unconventional sources of energy unless, indeed, they can be shown to be competitive with the conventional sources—as geothermal energy might be. The up-country power stations in villages, however, are handicapped by expensive fuel, low load factor and heavy maintenance charges, so that the energy produced by them usually costs between 3d and 7d per kWh and often more. A conference delegate from Nigeria mentioned the up-country diesel-electric stations, of 100 to 500 kW capacity, in his country: although the tariff for supplies from these stations is 5d per kWh, plus a fixed charge, they are run at a loss. He urged that wind power plant should be developed and installed for use as a complementary source of power to save fuel and reduce these costs. Another speaker, from Peru, mentioned a similar position in his country and supported the Nigerian delegate's plea.

For the remote areas the present prospects for power supplies from conventional sources are very poor. National grid networks in some countries will be developed so that, eventually, electricity will be generally available, but this will usually be a very slow process. As an illustration, the Government of India has had two five-year plans to develop the country's economy and rural electrification has formed an important part of them: the third plan (for 1961-66) is now being implemented. Yet, in spite of intensive efforts, only 29,458 villages out of a total of 556,565 with a population less than 5,000, will have been electrified by the end of the period. It must certainly take another 25 to 30 years (as Professor M. S. Thacker stated in Rome) before Indian rural electrification can approach completion. There is little doubt that underdeveloped countries lacking the resources, technical and financial, of India, will take an even longer time to finish such work. In fact many have not yet started to construct any major grid schemes.

### Different Approach

It is in these areas that locally available energy resources such as the wind and solar radiation—perhaps with some support from waste vegetation to drive standby heat engines when these random sources are not available—could make the greatest contribution. The installation of wind power or solar power plant can be regarded as a "temporary" measure to cover the interval until more conventional supplies can take over, but this time may be long and, indeed, experience and developments over the next 20 or 30 years might show that such plant could provide adequate supplies in its own right. Initially, a different attitude of mind from that of the rural development engineer in an industrialised country must be adopted. A power service of one-hundred-per-cent dependability should not be aimed at: if it is, the costs will often prove prohibitively high. But, if the remote communities accept a more limited service (as indeed they do now in the areas with small isolated power stations which run for only 12 or 18 hours in the day) this will be a great improvement on the present position when there is nothing at all. This situation was well understood by most of the delegates from the developing countries at the Rome conference and with some help in the form of information on what might be done based on the present state of our knowledge of these new sources of energy, immediate progress towards the provision of up-country power could be made.

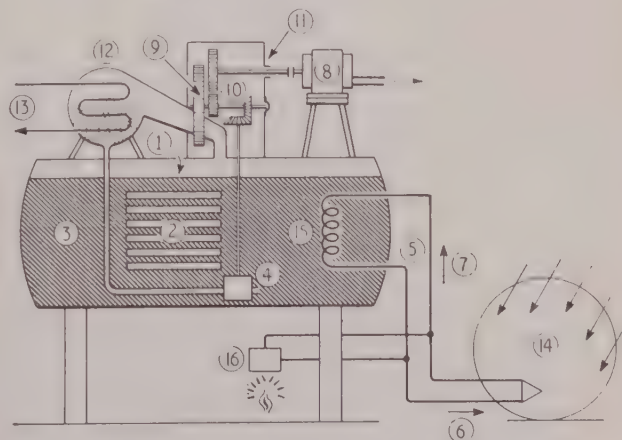
The discussions at the conference brought out the

differences between the three energy sources considered and indicated their present stage of development. Geothermal energy, which has already been developed to a total world installation of some 400 MW (of which 300 MW is in Italy), is, of course, a firm source of power with low production costs. In addition to electricity generation, there is the possibility of using the geothermal steam or hot water for domestic heating or for industrial processes and for the establishment of local industries based on the chemical products extracted from the hot water. At the Larderello plant, near Florence, which was visited by most of the conference delegates, there is an important chemical industry as a subsidiary of the power production. It is the only plant in the world producing natural boric acid on an industrial scale.

The initial prospecting, and subsequent drilling of bore-holes to prove the capacity and probable life of the geothermal fields, is, however, very costly and the minimum economic size of a power installation is about 1,000 kW. Although the exploitable geothermal areas are scarce, delegates gave evidence of some hitherto unsuspected areas where developments might be economically possible if further geological and geophysical surveys and explorations could be made. It was suggested that the United Nations might give some assistance in this direction. In the past the drillings to explore for geothermal energy have been on a relatively minute scale when compared with the millions of metres of bore-holes made every year in the search for oil.

### Wind Power

In the sessions on wind power, details were given of designs and costs for a number of wind-driven machines ranging in size from a few hundred watts to 800 or 900 kW. There was news of machines now being developed in Hungary and Japan as well as information on the operation of medium- and large-scale units in Algeria, Denmark, France, Germany and the United Kingdom. Valuable guidance on the principles underlying the selection of wind power sites and on the use of meteorological data was given in papers from India, Israel, United Kingdom, Uruguay, U.S.A. and the United Arab Republic. Among new uses suggested for wind-produced energy was that



Operating principle of solar power unit

1. Organic vapour. 2. Heat storage rods. 3. Organic fluid. 4. Feed pump.
5. Thermo-siphon circulation. 6. Hot water. 7. Steam. 8. Electric generator.
9. Single turbine wheel. 10. Reduction gears (18,000 : 3,000 r.p.m.).
11. Rotary shaft seal. 12. Vapour condenser. 13. Cooling water. 14.
- Stationary solar radiation collector (one of six required). 15. Heat exchanger.
16. Auxiliary heating



for collecting water from the atmosphere by a refrigerated surface. This could be useful in dry areas where fresh water supplies are scarce.

It was suggested that work on the subject of wind power had progressed far enough for wind-driven machines to be put into service and that the most important need, now, was to bring about closer liaison between the manufacturers and the potential users. The latter had little knowledge of what plant could be made available or of what it could do for them: until they were better informed they could not be expected to place orders. This is a field in which the United Nations might help by establishing, for both wind and solar energy, a network of information centres and also by co-ordinating and exchanging information from the many research and development centres.

### Solar Energy

In solar energy many lines of development, some of them greatly encouraged by the need for power sources in space travel, are being followed. A Japanese delegate stated that 350,000 solar water heaters of various types are now in use in Japan: this is a measure of the progress made in this relatively simple application of solar energy. Professor V. A. Baum, of U.S.S.R., who is well known for his work on solar energy at the Krzhizhanovsky Power Institute in Moscow, summarised the findings for his sections of the conference. He illustrated the progress made in the direct conversion of solar radiation to electrical energy in thermo-electric and photo-electric devices by stating that, within the last 10 or 12 years, the efficiency of this conversion had been increased 100-fold—from about 0.1 to 10 per cent.

The production of mechanical or electrical power from solar radiation (as distinct from the various applications not concerned directly with power) is being developed along three lines—through the two forms of direct converter just mentioned and through different forms of heat engine. Professor Farrington Daniels, of Wisconsin University, who summarised the discussions on this subject,

said that he would not like to predict which of the three methods would win in the race to provide solar power economically.

A 5 h.p. solar power unit developed by the National Physical Laboratory of Israel was demonstrated at a site near Rome. It has a solar collector in the form of an inflated plastic mirror which provides a low-cost focusing reflector with a long life at full efficiency. It is claimed that the turbine, the operating principle of which is shown in the diagram, has an efficiency of about 15 per cent. A new storage system, using the heat of fusion of the stored material, provides a constant temperature of 150°C for the turbine despite sunshine variations and allows 24-hour operation of the plant. Tentative costs for the plant, which includes a 220 V, 50 c/s alternator, are given as 1,000 U.S. dollars per kW.

Among many other applications of solar energy discussed in separate sessions were solar cooking, the distillation of brackish water in solar stills, drying, cooling and the storage of foodstuffs, heat storage, air-conditioning in solar houses, and solar furnaces for metallurgical research.

In a session on the combined use of different local energy sources for power supplies to remote communities, energy storage was discussed and one of the British papers—on fuel cells—was presented by Mr. F. T. Bacon.

There can be no doubt whatever that this conference, which was officially opened by His Excellency Signor Egidio Ortona, Director General of the Department of Economic Affairs of the Government of Italy, and at which Sir Vincent Z. de Ferranti presided over the first general session, was a great success. It brought together, for the first time at this level, those who were interested in the development and utilisation of these new energy sources. Well organised by the U.N. Secretariat, the meeting gave every encouragement for the free and friendly exchanges of information which took place. It is to be hoped that these efforts will soon achieve results in implementing some of the suggestions made to help the power-deficient developing areas.

## MOTOR CONTROL GEAR MAINTENANCE

A NEW Code of Practice on the maintenance of electric motor control gear, CP1011, has been published by the British Standards Institution. The various statutory regulations with which electrical installations may have to comply are indicated, together with such important general matters as inspection, observance of manufacturers' instructions, and the analysis of faults. An important section deals with the safety of personnel operating the installation, and emphasises such precautions as isolation before maintenance work is carried out; the use of voltage indicators; special precautions in dealing with oil-immersed equipment; and maintenance of earthing connections. Notes are included on first-aid and fire extinguishing equipment.

The main section of the code sets out general principles of maintenance which are applicable to most types of equipment, followed by detailed recommendations for various types of control gear including contactors, drum controllers, overload and time-delay devices, liquid starters and controllers, push button and similar auxiliary devices, isolators and composite units of switches and fuses. There

is a list of special equipment (other than tools normally used by the electrician) which may be needed for carrying out the recommendations of the code.

This Code may be obtained from the British Standards Institution, 2, Park Street, London, W.1, price 6s.

### Dispersion Meter Instruction Manual

AN instruction manual for the dispersion meter, model 2A, designed by the Electrical Research Association, has already been issued as Report ref. V/T135. Further development has since resulted in the production of the model 4A, which allows dielectric dispersion of insulation to be measured on two alternative time ranges. For one of these time ranges (3-300 msec), the instrument and the measurement which it makes are identical with those for model 2A. The additional time range (0.1-3 sec) is provided to increase the scope of the instrument. An instruction manual for this model (Report ref V/T141) is now available from the publications sales department of the Association at Cleeve Road, Leatherhead.



# Permanent Magnets for Repulsion Systems

By MALCOLM McCAIG, Ph.D., F.Inst.P.\*

Recent improvements in the properties of magnetic materials have made possible the use of permanent magnets for a variety of repulsion devices. These range from novelties in children's toys to almost frictionless bearings of the type which are now coming into use in electricity meters. This article explains the principle of such systems and deals in some detail with the design problems involved

ALTHOUGH Earnshaw's theorem shows that magneto-static forces cannot support a body in stable equilibrium, the repulsion between permanent magnets can support the whole weight of a body. The sideways restraint which is still necessary can then be made very small by careful adjustment. This principle has been used to design bearings with very low friction for watt-hour meters.

Complete levitation without any material support can be achieved using electromagnetic devices. The apparatus required is, however, very elaborate and expensive both in initial cost and power consumption and does not compete with permanent magnets for the kind of applications considered here.

There are very little data available which would enable magnets to be designed to produce a given repulsion force. The magnets usually present large surface areas in close proximity to one another, and in these circumstances the point pole approximations of elementary magnetostatics are completely useless. Theoretically, each magnet in a repulsion device must be treated as having a surface distribution of pole strength and the force must be integrated over all the interacting surfaces.

In the following pages a number of magnet systems for repulsion are considered, methods of estimating the repulsion force are suggested and compared with experimental determinations.

It seems possible that if the force of repulsion is known between two magnets of a given material, size, shape, configuration and distance apart, it could be calculated for certain other values of the size and distance apart, provided the material, shape and configuration of the magnets are kept the same and the principles of similarity are correctly applied.

The principles of similarity require that the linear dimensions of the magnets and their distance apart shall all vary in the same ratio. If this condition is fulfilled, since the magnetic material is unchanged and the positions

of the magnets relative to one another are the same, the distribution of magnetisation and polarity in the magnets is the same. Thus the force of repulsion will vary as the superficial area of the magnets (i.e. as  $L^2$  where  $L$  is any linear dimension). For many purposes the force per unit mass or per unit volume is important. The force per unit volume varies as  $L^2/L^3=L^{-1}$ , i.e. inversely as the linear dimensions.

An experimental test of this theory is shown in Table 1.

TABLE 1.—TEST OF METHOD OF SIMILITUDE FOR ESTIMATING FORCES OF MAGNETIC REPULSION

Disposition of Magnets				Dimensions of Magnets. cm								
				4.6 × 1.0 × 1.0			2.3 × 0.5 × 0.5			9.2 × 2.0 × 2.0		
				d	F	F/A	d	F	F/A	d	F	F/A
Single Pole	...	...	...	0.0	245	245	0.0	73	292	0.0	1,400	350
				0.5	135	135	0.25	44	176	1.0	710	178
				1.0	92	92	0.5	27.5	100	2.0	400	100
Double Pole	...	...	...	0.0	300	300	0.0	120	480	0.0	1,670	418
				0.5	163	163	0.25	53	212	1.0	1,080	270
				1.0	112	112	0.5	33.5	134	2.0	685	171
Ditto Min. d = 0.32	...	...	...	0.4	300	300	—	—	—	0.8	1,260	315
				1.0	169	169	0.5	41.5	166	2.0	740	185
				1.5	108	108	0.75	31.0	124	3.0	475	119
				Dimensions of Magnets. cm								
				6.7 × 1.0 × 1.0			3.4 × 0.5 × 0.5					
				d	F	F/A	d	F	F/A			
Single Pole	...	...	...	0.0	375	375	0.0	90	360			
				0.5	240	240	0.25	55	220			
				1.0	155	155	0.5	35	140			
Double Pole	...	...	...	0.0	725	725	0.0	113	452			
				0.5	415	415	0.25	83	332			
				1.0	275	275	0.5	62	248			
Ditto Min. d = 0.32	...	...	...	1.0	505	505	0.5	67	268			
				1.5	310	310	0.75	50	200			

Different sizes of rectangular Alcomax bar magnets were used. The relative positions of the magnets for double-pole repulsion and single-pole repulsion and the definition of the distance  $d$  are explained by Fig. 1.  $A$  is the area of any representative face of each magnet relative to that of the first one considered along any horizontal row of figures for which the dimensions of the magnets vary in the same proportions. For each pair of magnets and disposition the force in grammes is shown for two or three values of  $d$ . After magnetisation the magnets were brought up to the minimum distance stated (or to contact when no other distance is stated) before any measurements were made. If we read along any horizontal line of figures, we find data for magnet dispositions such that  $d$  varies as the linear dimensions of the magnet. Therefore  $F/A$

\* Permanent Magnet Association.



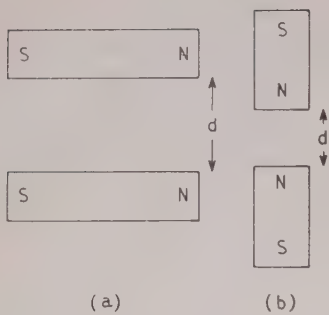


Fig. 1.—Disposition of magnets for (a) double pole repulsion, (b) single pole repulsion

should, according to the theory of similitude, remain constant.

Although there are considerable variations from this rule, the method does give a valuable guide to the order of magnitude of the forces to be expected.

### Theoretical Possibilities

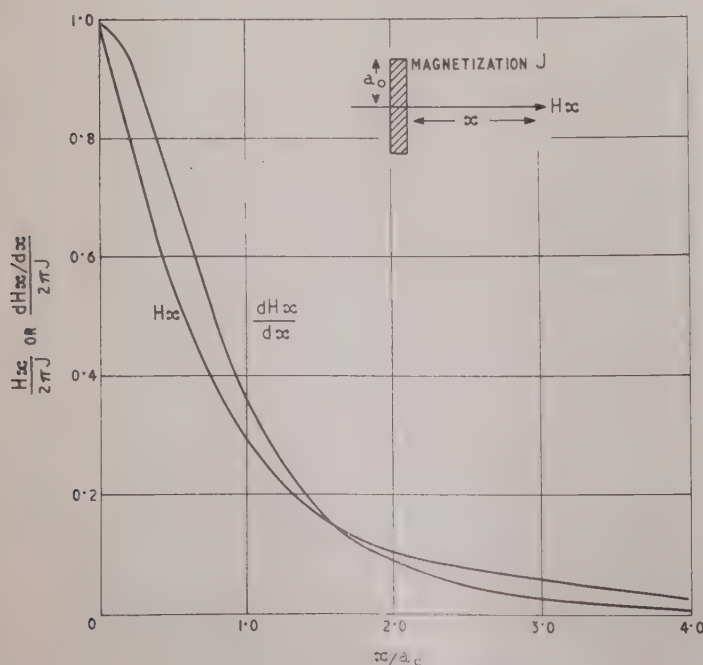
The force acting on a small magnet when placed in a field gradient is

$$F = VJ \left( \frac{dH}{dx} \right) \text{ dynes} \dots \dots \dots 1$$

$$V = \text{volume (cm}^3\text{)}, J = \text{magnetisation (e.m.u.)}$$

This equation shows that it is not necessary to have large fields in order to support a magnet. In fact efficient supporting systems can be devised in which the average field over the volume of the supported magnet is zero. In general the value of  $J$  varies from point to point in a magnet, both because of variations in its own self-demagnetising field and because of the gradient of the applied field. With alloy magnets these variations in  $J$  are so great that it is very difficult to make any estimate. With barium ferrite magnets, which have a much higher coercivity,  $J$  varies only slightly for considerable variations of  $H$ , and the prospect of successful calculations is much better.

Fairly good estimates of the fields produced by barium ferrite magnets can be made assuming the magnets are uniformly magnetised so that there is a uniform distribution of polarity on the end faces and no polarity elsewhere



on the magnets. The field on the axis of a circle of uniform polarity is given by the formula

$$H_x = 2\pi J \left( 1 - \frac{x/a_0}{(1 + x^2/a_0^2)^{3/2}} \right) \dots \dots \dots 2$$

$x$  = distance along axis from centre of circle.

$a_0$  = radius of circle.

$J$  = pole strength per  $\text{cm}^2$  on circle = intensity of magnetisation of material behind the surface.

Differentiating equation 2 we obtain

$$\frac{dH_x}{dx} = \frac{2\pi J}{(1 + x^2/a_0^2)^{3/2}} \dots \dots \dots 3$$

Fig. 2 shows the functions of equations 2 and 3 divided by  $2\pi J$  plotted against  $x/a_0$ . In general, it is necessary to make an estimate of the average value of the field due to the supporting magnet over the whole volume of the supported magnet.

Two methods have been tried for calculating the fields at points off the axis of the circle. The first method gives the answer in terms of a series involving surface zonal harmonics. This method breaks down when the distance  $r$  from  $O$  of the point  $P$  at which the field is required (see Fig. 3) is equal or nearly equal to  $a_0$ , the radius of the circle. In these conditions the series fails to converge. When, however,  $r \gg a_0$  or  $a_0 \ll r$  the method is comparatively simple.

In the second method the expression obtained for the axial component of the field at  $P$  is

$$H_x = \int_0^{a_0} \frac{4 J a r \cos \Theta E(k_1 \frac{\pi}{2})}{(a^2 + 2ar \sin \Theta + r^2)^{3/2} (1 - k^2)} da \dots 4$$

where  $k^2 = 4ar \sin \Theta / (a^2 + 2ar \sin \Theta + r^2)$  and  $E(k_1 \frac{\pi}{2})$  can

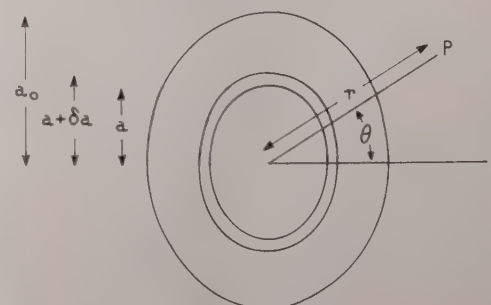
be found from tables of complete elliptic integrals of the second kind. Equation 4 can only be integrated numerically and the calculation is more laborious than the first method where that can be used.

Fig. 4 shows the ratio of the axial field at distance of  $y/a_0$  from the axis to the value of the field at the corresponding point on the axis; the first method was used when  $r \gg a_0$  and the second when  $r \approx a_0$ . Using Figs. 2 and 4 the axial field at a point off the axis can be deduced.

At points off the axis there is also a radial component of the field, but since all the problems dealt with in this article have radial symmetry, the radial components of the force cancel. Although the radial components of the field

Fig. 2 (left).— $H_x$  and  $dH_x/dx$  plotted against  $x$  according to equations 2 and 3

Fig. 3 (below).—The field at  $P$  due to surface of uniform polarity of radius  $a_0$  is required





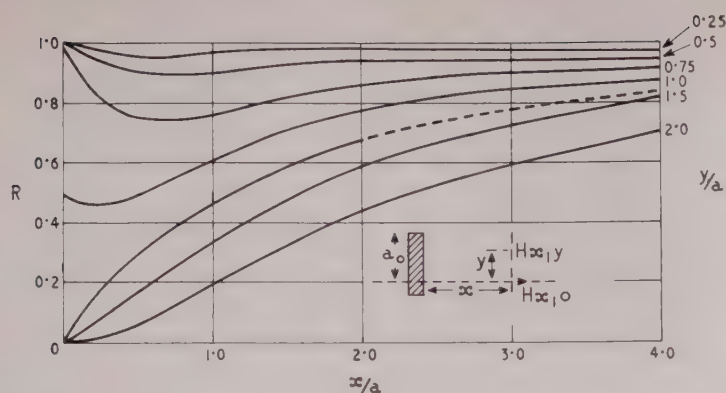


Fig. 4.—Ratio of axial components of fields off and on the axis  
 $R = H_{x,y}/H_{x,0}$

are no more difficult to calculate than the axial components, we have not included these calculations here.

When the field due to a uniformly magnetised cylindrical magnet is required, the contributions from both ends must be calculated and added vectorially. Most of the magnets which we have used had a central hole. The easiest way of calculating the field due to such a magnet is to calculate the value of the field due to the whole circle and then to subtract that due to a circle of area equal to the central hole.

### Comparison of Theory and Experiment

The magnets chosen for the comparison of experimental and calculated values of the repulsive force are shown in Fig. 5. The same fixed magnet was used for each experiment, but magnets with two different lengths were used for the supported magnets. The supported magnet was free to move up and down a smooth rod passing through its central hole and weights were placed on it to determine the load which it could support at various distances above the fixed magnet. The internal and external radii of all the magnets were the same.

The calculation of the field due to the fixed magnet throughout the volume of the supported magnets and hence of the supporting force involves various approximations which depend on the geometry of the problem and the accuracy required. The procedure adopted in our case was as follows. At a given distance from the

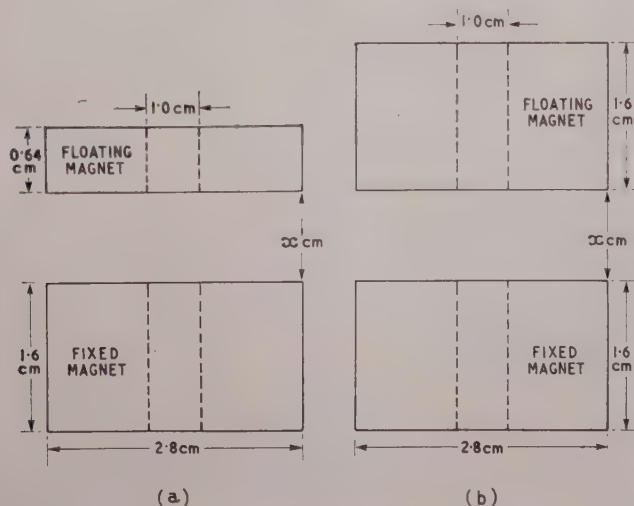


Fig. 5.—Pairs of magnets used for repulsion experiments

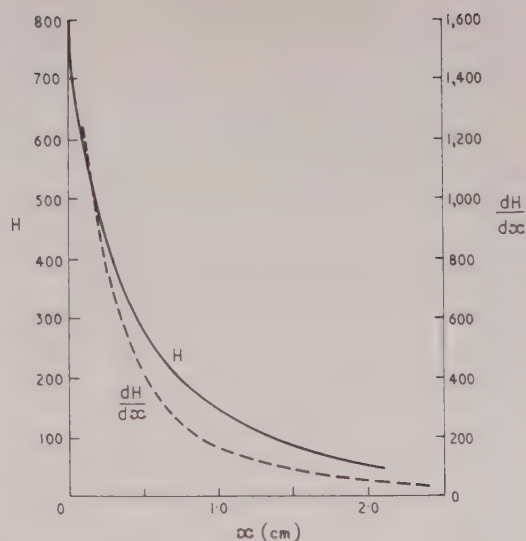


Fig. 6.—Calculated  $H$  and  $dH/dx$  at axial distances  $x$  from the supporting magnet. The values are averaged over the area of the supported magnet

fixed magnet the axial component of the field was calculated for  $y=a_0/2$ ,  $y=3a_0/4$  and  $y=a_0$ . Since the supported magnet has a central hole, the value of the field on the axis itself is not relevant. By suitable weighting, the mean field between radii of  $0.357a_0$  and  $a_0$  was estimated. ( $0.357a_0$  is the radius of the central holes.) The process was repeated for other axial positions and the data for Fig. 6 were obtained. This shows the mean values of  $H$  and  $dH/dx$  plotted against  $x$  the axial distance. The method of calculating the force was as follows:—

- (i) A given distance between the supported and fixed magnet was selected.
- (ii) Eight or nine positions along the length of the supported magnet were chosen.
- (iii) The mean value of  $H$  for each of these positions was read off from Fig. 6.
- (iv) The corresponding values of  $J$  were obtained knowing the demagnetisation curve and shearing lines for the magnets (Fig. 7).
- (v) For each position along the length of the supported magnet the product of the mean value of  $J$  from (iv) above and the mean value of  $\frac{dH}{dx}$  from Fig. 6 were used according to equation 1 to calculate the contribution to the force.

(vi) The total force was obtained by summing the results of (v) above for the whole length of the supported magnet.

In an additional experiment the field due to the fixed magnet was measured in various positions using a Hall probe. The results were averaged over the annular area of the supported magnet in a fairly similar manner to that used for the calculated values. The resulting average

values for mean  $H$  and  $\frac{dH}{dx}$  plotted against  $x$  are shown in Fig. 8. The reader can compare the calculated and measured fields by comparing Figs. 6 and 8, but perhaps a better comparison can be obtained from Fig. 9 in which  $F/W$ , the ratio of force to weight of magnet, is plotted against  $x$  for the two lengths of supported magnets, taking the density as  $4.9 \text{ gm cm}^{-3}$ . Three curves are given for each magnet: measured, calculated using measured  $H$ , and calculated using measured  $H$ . The agreement here is quite encouraging. It seems likely that when averaged



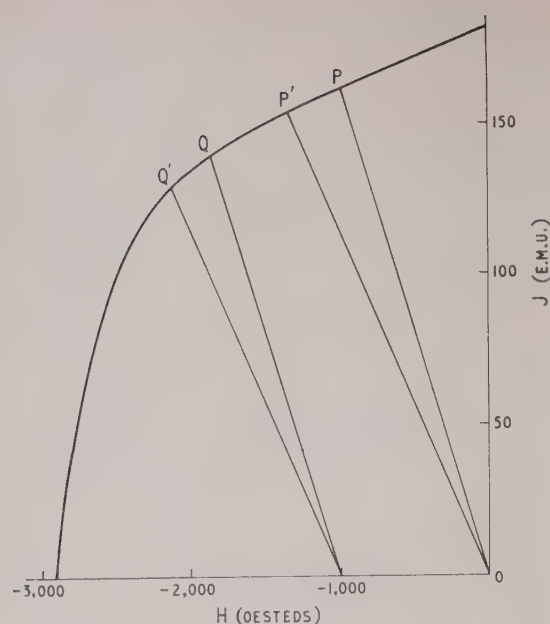


Fig. 7.— $J$ ,  $H$  curve for Feroba.  $P$  and  $P'$  are the working points for the rings 1.6 and 0.64 cm thick in zero applied field.  $Q$  and  $Q'$  are the working points in an applied field of  $-1,000$  oe. The  $J$ 's for any other applied field can be found similarly by drawing parallels to  $OP$  or  $OP'$

over the whole magnet some of the differences between measured and calculated  $H$  are ironed out.

The extreme values of  $J$  found in the supported magnets were 147 and 156 e.m.u. For such a small variation of  $J$ , the method of calculation was perhaps rather more elaborate than necessary. It might have been sufficient to consider a mean value of  $J$  for the whole supported magnet and the values of  $H$  due to the supporting magnet at each end of the supported one. With alloy magnets the variations of  $J$  are so large that the calculations become very difficult. The method of similitude is still easy to apply.

### The Maximum Force/Weight Ratio

When considering the principles of similitude we concluded that for a given material and configuration, the force to weight ratio  $F/W$  varies inversely as the linear

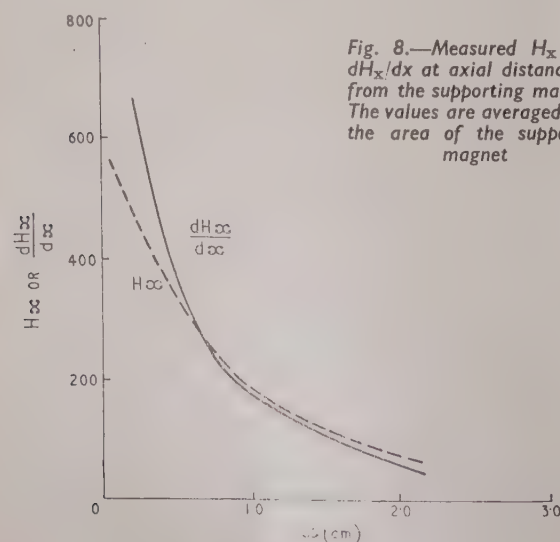


Fig. 8.—Measured  $H_x$  and  $dH_x/dx$  at axial distances  $x$  from the supporting magnet. The values are averaged over the area of the supported magnet

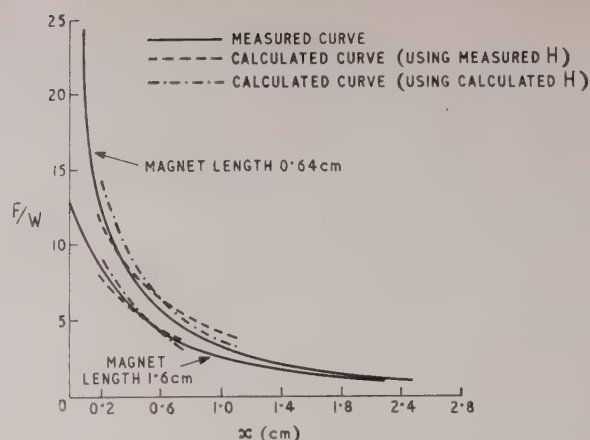


Fig. 9.—Measured and calculated force/weight ratios

dimensions. This means that the best ratios will be obtained with small systems and that for any material and configuration there must be a maximum size of magnet that can be supported at all. In the present experiments with two equal barium ferrite magnets, each weighing 41 gm, the maximum ratio  $F/W$  was 12.7. With a pair of small ring magnets, each weighing about 1.9 gm, a value of  $F/W$  up to 30 has been obtained.

With a given size of magnet to be supported the ratio  $F/W$  may, however, be increased by using a larger fixed magnet. The possibility of using systems of two or three

TABLE 2

Dimensions (cm)	Supported Magnet Weight (gm)	Density gm/cm <sup>3</sup>	Working 4πJ	Force/Weight, Maximum Ratio			
				3-ring system, dH/dx 4πJ		850 2-ring system, dH/dx 1,040	
1.12 d × 0.35	1.6	4.9	1,700	measured	calculated	measured	calculated
1.12 d × 0.7	3.2	4.9	1,700	25.6	24	30.5	29.5
0.9 d × 0.7	1.8	4.9	1,700	25.3	24	30	29.5
				21	24	25	29.5

ring magnets to produce a large field gradient at zero field has also been investigated. Barium ferrite rings of 8 cm outside diameter and 2.8 cm inside diameter were used. In one system two such rings, 1.4 cm thick, were magnetised axially and placed with like poles together. The best field gradient was 1,040 oe/cm, when the distance between the rings was 0.36 cm. A three-ring system with the rings magnetised radially was also tried. The centre ring had a S pole in the centre and the outside rings N poles in the centre. The inside ring was 1.4 cm thick and the outside rings each 1 cm thick. The maximum gradient was obtained with 0.35 cm separation between the inner and outer rings. It was, however, only 850 oe/cm.

In Table 2 the  $F/W$  ratios obtained with these systems on three different supported magnets are compared with values calculated by equation 1 from the measured field gradients. The agreement is quite good and the ratio of 30 obtained on a magnet weighing 3.2 gm is probably the best overall performance we have obtained.

### Acknowledgments

The author thanks the Permanent Magnet Association for permission to publish this paper. Dr. N. Davy, of Nottingham University, and Mr. J. C. Williamson, now of Sheffield College of Technology, have given invaluable advice on some of the calculations. Mr. R. Scholes and Mr. R. M. Higginbottom made most of the measurements.

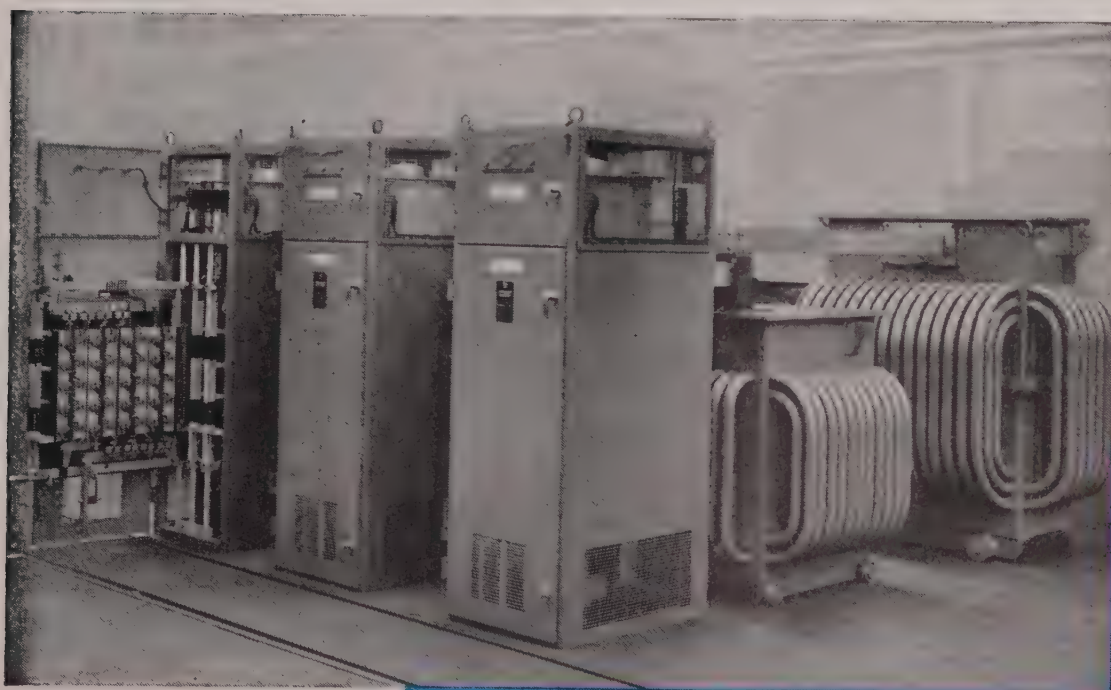




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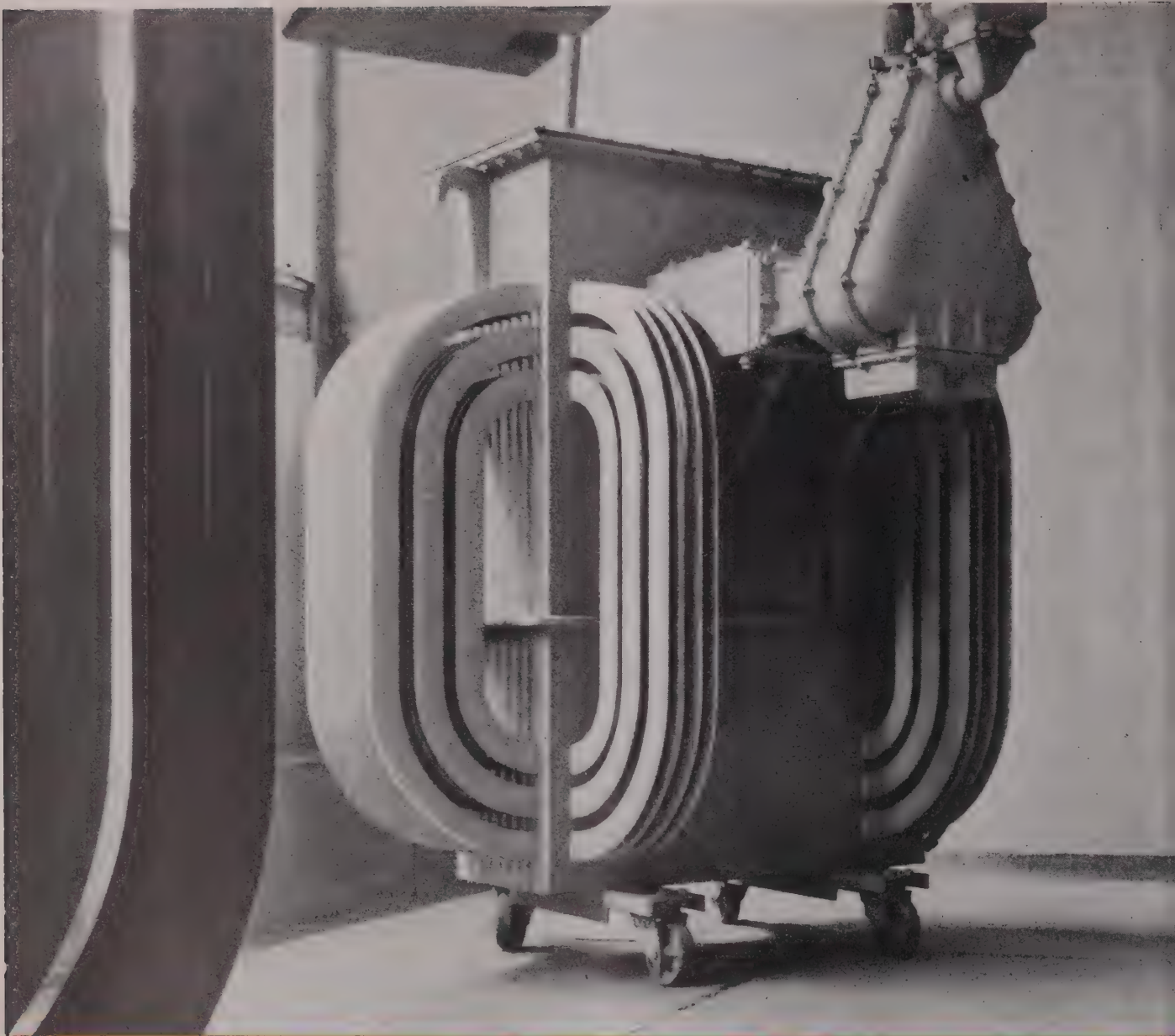


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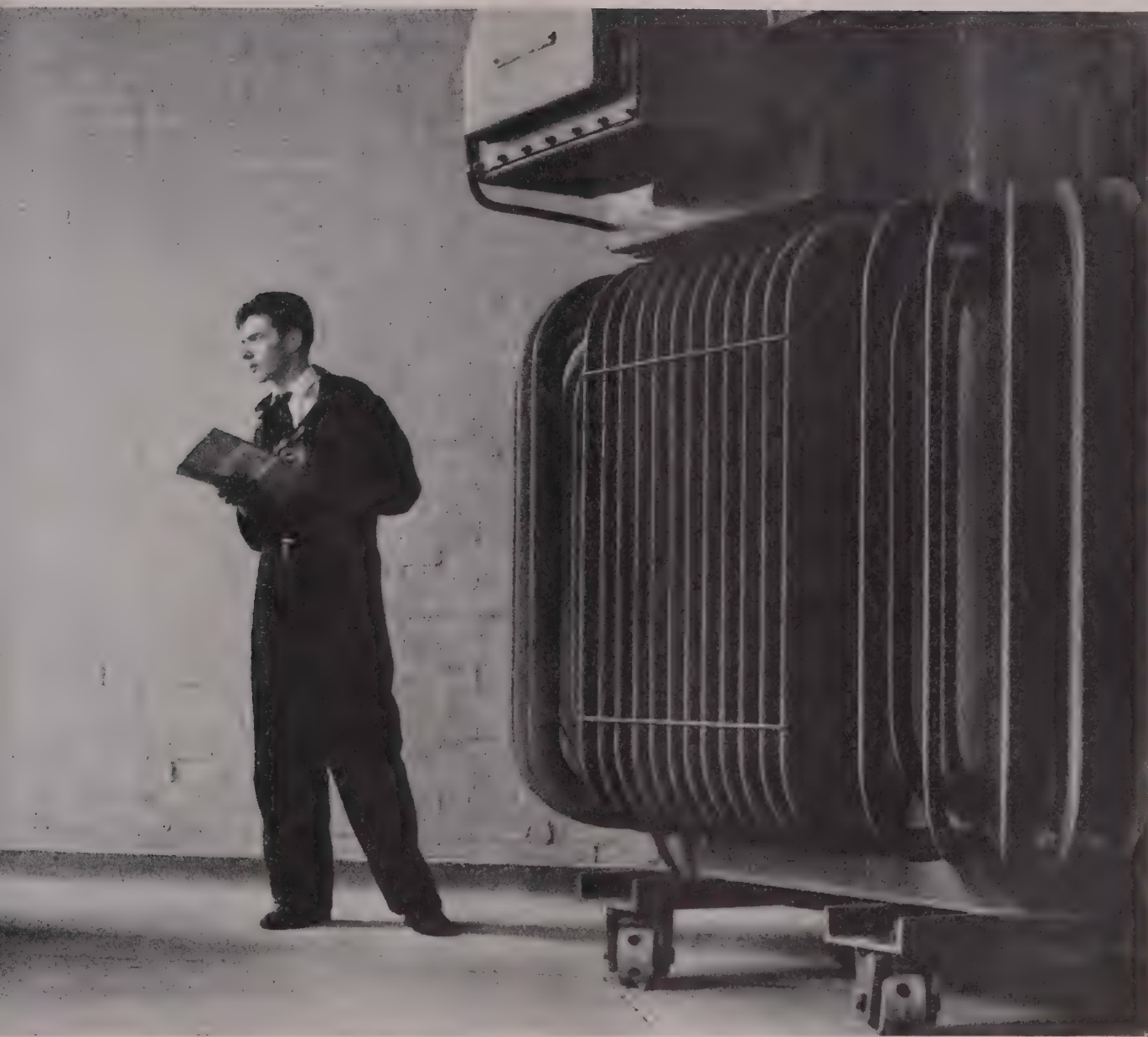




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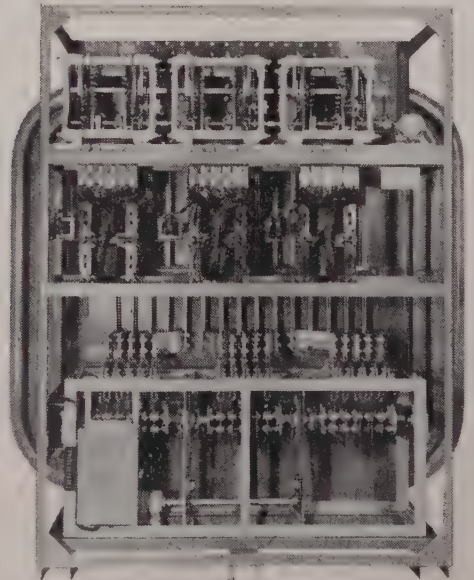


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## LETTERS TO THE EDITOR

*Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents*

### Successful Before Nationalisation

WILL you please allow a voice from the past to comment on the B.B.C. programme (of Thursday last week from Crawley New Town) in which Sir Christopher Hinton and Mr. Norman Elliott answered questions about electricity supply. As the affair was on the Light Programme it ought not, perhaps, to be taken too seriously, but some of the remarks were clearly intended to be serious and must have been so regarded by anyone who had the fortitude, as I had, to listen to the bitter end.

The question of nationalisation was raised by an obvious critic. Let me say at once that in my view (a) a drastic extension of public ownership in the electricity supply industry was inevitable after the last war, and (b) the people in the industry have gone a long way to make nationalisation a success. But two arguments advanced by Sir Christopher Hinton were misleading and are open to criticism.

Sir Christopher stated that without nationalisation it would have been impossible to create a national grid by which supplies generated in one part of the country could be transmitted to other parts. This is a typical remark of the many people who talk as if our great industry was not born until 1st April, 1948. The fact is, of course, that the old Central Electricity Board started on the grid in the 1920's. Over 30 years ago they were constructing 132 kV lines in different parts of the country, and later on these lines made a momentous contribution to our war effort. Does anyone imagine that the men responsible for that enterprise, men like Charles Merz, Archibald Page, Leonard Pearce and William Wood, who are no longer here to speak for themselves, would have been placidly content with their achievements? These and other engineers were men of action and vision whose pioneering work would have continued either with or without nationalisation; and they would not have needed the inflated staffs and vast office buildings which seem to be inseparable from our present-day Parkinsonian existence.

Another questioner at Crawley raised the subject of electricity charges, complaining that they were constantly rising. Sir Christopher put forward the apparently stock answer that the price of electricity has not risen as steeply as the prices of other commodities. This soothing reply ignores certain facts which ought to be considered. For 60 years before nationalisation—and please remember that the industry started 60 years before 1948—the price of electricity to consumers in this country was reduced, almost year by year, and but for the war would undoubtedly have gone on declining. By now it would probably have been at half the pre-war level instead of being, as it is, about 50 per cent above. In other words, electricity is roughly three times the price it would have been but for the war. In the United States, where most prices have risen even more steeply than in Britain, the price of electricity still remains lower than it was before

the war. Being retired and without the latest statistics I cannot give the most accurate figures, but even if I am slightly off the beam I suggest that we ought not to suffer from undue complacency.

I have a final comment on Thursday's broadcast, a broadcast which was described by the announcer and by many listeners as the best advertisement received by the gas industry for years past. In reply to a question about the widespread blackout in South-East England in May last, Sir Christopher very properly, but rather offhandedly, I thought, gave the reasons and excuses for the trouble. Everyone had been wrong and dilatory except the Generating Board. From the point of view of public relations it would surely have been wise and courteous if he had uttered a sincere expression of regret at the grave inconvenience caused to the general public.

In short, I suggest to all newcomers to our industry that they should sometimes have a sympathetic regard for their customers and also have an occasional thought for the great work done by the men who created, in the face of immense difficulties, the industry which was in such an efficient state when nationalisation came in 1948.

Woking, Surrey.

H. J. RANDALL.

[Mr. Randall, as many readers will know, was managing director of the City of London Electric Lighting Co., Ltd., from 1940 to 1948. He was then chairman of the London Electricity Board until 1956.—Editors, *Electrical Review*.]

### Twin Panel Television Tubes

I REFER to the article "The Radio Show" by Mr. E. A. W. Spreadbury in the *Electrical Review* of 25th August. This describes the advantages of a twin panel laminated form of television tube but implies that the only form of integral front panel is a plastic one, and being plastic it is possible to incorporate "ears" for mounting lugs and a special front coating to improve picture contrast.

I should like to point out that both glass and plastic forms of integral mask are available and both are provided with "ears" for mounting lugs. Some of the glass types displayed were provided with an anti-reflection front finish which improved picture contrast. A roughening of the front surface of a plastic twin panel is possible, but the majority of tubes on show having anti-reflection finishes were made with glass twin panels.

St. Helens, Lancs.

K. BOOTHROYD  
(Pilkington Brothers, Ltd.)

### "Underground" the Supergrid

IN reply to C.B.'s letter (25th August issue) and Mr. J. R. Harding's (1st September), I would point out that my article bearing the above title in your issue of 14th July did not propose the installation of "many miles" of 275 kV underground cables, but made reference only to urban and suburban areas, and possibly also where overhead lines



could justifiably be regarded as impracticable, such as for really serious æsthetic reasons. Perhaps I should have added the words "Here and There" to the title of my article.

In spite of the high voltage, the resultant capacitance effect of these relatively short runs of underground cable would be infinitesimal in comparison with that already in existence in the form of underground cables at 132 kV and lower voltages, so that system stability would not be jeopardised.

If my article has had no more effect than to bring about abandonment by the C.E.G.B. of the misleading assertion in public advertisements and at public inquiries that 275 kV underground cables cost 17 times as much as overhead lines, then it will have achieved its primary purpose. It is significant that my submissions have not been refuted by or on behalf of the C.E.G.B.

London, W.1.

IAN M. E. AITKEN.

### Expansion of "Underground" Essential

THE growing importance of the Underground Railways, and the need for their modernisation and extension, is emphasised in the annual report for 1960 of the London Transport Executive published this week.

Against a fall in the number of road services passengers (mainly short-distance riders) from 2,756 million to 2,593, passenger travel on the Underground Railways continued to grow in 1960, reaching 674 million—an increase of 0.8 per cent over 1959. This expansion is attributed to an increase in population in the outer areas, the introduction of new trains of greater carrying capacity on the Piccadilly and Central Lines and a transfer of passengers from the depleted bus services, and to controls on the parking of cars in Central London. The Underground also carried a greater proportion of short-distance riders in 1960.

The report says the new rolling stock programme would afford some easement and stimulate some new traffic in the next few years, but peak-hour traffic continues to rise even though at many important points an acceptable standard of comfort and convenience is not, at times, being offered. The position would only improve when the train replacement programme was completed, the Victoria Line had been built and other works carried out. "The conclusion is clear that improvements to the Underground system done in the right way and at the right places which will make journeys quicker or easier are certain to lead to an increase in Underground traffic and a corresponding reduction in traffic seeking to use road vehicles; and the same applies to British Railways lines in the London area. London Transport is confident that expansions and improvements of the Underground system as a whole, though usually costly to provide, must be taken in hand as an essential element in any solution of the general London traffic problem."

Referring to its doubts on the need for urban motorways in London, the Executive point out that experience with the Toronto Subway has shown that one mile of tube railway costing £5 million is worth five miles of urban motorway costing five times as much.

Mention is also made of the progress in the delivery of

new rolling stock, the extension and widening of electrified lines, the modernisation of signalling and the electrical distribution system. Further progress is also recorded in the complex planning for the Victoria Line and experiments have shown that costs of tunnelling can be substantially reduced and the speed of construction improved.

### Nuclear Lubricants

A PAPER by Mr. P. E. C. Vaile entitled "Lubricants for Nuclear Reactors" was presented at an ordinary meeting of the Institution of Mechanical Engineers at the Social Club of the Hoffmann Manufacturing Co., Ltd., Chelmsford, yesterday (Thursday).

The earlier British carbon-dioxide-cooled, graphite-moderated power reactors, he said, had been designed to operate without lubrication. This had been necessitated by lack of knowledge of the effects of radiation and other reactor operating conditions on lubricants, and of the degree of compatibility of lubricants with reactor materials.

Investigations carried out over the past few years of the effects of nuclear radiation on many types of lubricant had shown that it was possible to produce materials capable of lubricating some reactor components. To further the development of such lubricants, the U.K.A.E.A. and the nuclear manufacturing groups had co-operated in providing lubricant manufacturers with details of design and operating conditions of reactor components which it was desirable to lubricate.

Mr. Vaile's paper described the range of operating conditions which lubricants were expected to encounter in different reactors, with particular emphasis on the CO<sub>2</sub>-cooled, graphite-moderated reactor. Nuclear lubricant requirements proposed by the U.K.A.E.A. to cater for many applications were also discussed.

With this information available, it was now possible to assess realistically the types of test facility necessary for the evaluation of nuclear lubricants. Such test facilities were described. They included irradiation sources, a test rig for running under irradiation conditions, various test rigs to simulate reactor operating conditions for testing products both before and after irradiation, and other specialised equipment.

The effect of radiation on both conventional and nuclear lubricants was described and the use of "anti-rads" illustrated. Attention was drawn to other desirable properties of nuclear lubricants such as temperature stability, low volatility and compatibility with reactor and fuel-can materials.

Designers of reactor machinery had taken, and would increasingly continue to take, advantage of the developments in lubricants but, while still further advances in lubricant quality would be made, some components, particularly of the more advanced types of reactor, would probably continue of necessity to be operated without lubrication.

Domestic Supplement — Electric Blankets —  
at the end of this issue



# VIEWS on the NEWS

By "REFLECTOR"

WE are accustomed to transatlantic and Russian claims to have been first, but I think we must still enter a mild protest on occasion. A New York correspondent has sent me a cutting from the *New York Times* in which a despatch from Niagara Falls, N.Y., is reproduced. This says:—

"The generators of the world's first alternating-current power plant will soon produce their last kilowatt. They produced the power that on Nov. 16, 1896, was transmitted twenty-five miles to Buffalo in the world's first long-distance transmission of electricity."

Although these generators may claim antiquity they cannot pretend to priority. It was round about 1885, at least ten years earlier, that S. Z. de Ferranti began supplying a.c. from the Grosvenor Gallery. As to the "world's first long-distance transmission" I am not so sure. I suppose that 25 miles was a long way in those days.

\* \* \*

I have noted on previous occasions the propensity of some Africans to help themselves to sections of overhead lines which they often adapt to decorative uses. Now *Aluminium News* (Toronto) tells of an unusual dodge employed on a ranch in Kenya to circumvent this practice. On this ranch the aluminium wire used for transmission was liable to be removed and so the owner has substituted aluminium barbed wire. This seems to have been effective so far, but if the natives can find a use for the barbed wire they will no doubt also find a way of handling it.

\* \* \*

Last week's B.B.C. programme on electricity supply in the "Listeners Answer Back" series was not the lively affair that I had anticipated. An invited audience at Crawley New Town questioned Sir Christopher Hinton, chairman of the Central Electricity Generating Board, and Mr. Norman Elliott, chairman of "Seeboard," on such matters as the power failure in South East England last May, the use of overhead lines instead of underground cables, electricity charges and off-peak tariffs (which drew a hint of the possibility of some concession next year) but I felt that the case book of the Area Consultative Council would have provided complaints on which consumers could have "answered back" with more conviction.

\* \* \*

"Only Gas Central Heating Answers All Your Fuel Problems" says an advertisement now freely appearing in the newspapers. Now this is a debatable claim and it is not

strengthened by a further remark that "Central heating's at its cleanest with gas—free from work and free from smell." Electricity, at least, does not need exhaust arrangements for it is quite odourless. And why does the Gas Council in the same advertisement offer "free life insurance for purchasers up to 56 years old"?

\* \* \*

I am sorry to keep on harping on gas but it forces itself on my attention. A correspondent has sent me a photograph, reproduced herewith, of the gas showrooms in Dun



Laoghaire (formerly Kingstown), Ireland. Apparently there is a theatre in these premises and the picture shows an announcement of the current play, by Kenneth Horne, which seems to have an unfortunate title.

\* \* \*

A steam-electric train which was expected to reach speeds of up to 80 m.p.h. on the level was described in the *Electrical Review* 70 years ago (11th September, 1891):—

"In a new system of electric railways invented by Herr Heilmann, a steam engine and dynamo are carried in a vehicle which takes the place of the present locomotive. Current is conveyed by conductors, which pass under the carriages, to a series of electric motors, which drive some or all of the axles. A triple expansion engine is to be used, and in order to ensure equal work being done by all the motors, their armature coils are all in series with one another, and current is supplied from one dynamo. The field magnets of the motors and of the generating dynamo are excited by current from a dynamo working at a constant potential. The boiler is capable of developing 600 horse-power, and is of the type in general use on the torpedo boats."



## New Books

**An Introduction to Electrotechnology.** By S. J. Kowalski. Pp. 301; figs. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 35s.

The fundamental concepts of electrical technology are so essential to the equipment of every engineer that many different treatments of the subject are needed to suit students in the various educational streams. Most of such works tend to fall into one of two categories. Either a careful avoidance of mathematics leads to a superficial descriptive treatment or the theory becomes so generalised that it gives rise to complex mathematical expressions which discourage all but the very advanced students. In this book the author has succeeded in maintaining a middle course between these extremes by means of an explicit text and clear diagrams with the essential mathematical relationships derived where necessary. A knowledge of differential equations is assumed but the use of complex numbers is introduced in an explanatory chapter.

Following an informative introduction, the first chapter on d.c. circuits devotes considerable space to the fundamental ideas of potential, e.m.f. and p.d. which are clearly explained (although the purpose of making  $E$  interchangeable with  $-V$  is not apparent). The chapter also contains clear statements of the main circuit theorems with examples worked in detail. Subsequent chapters deal with electrostatics and electromagnetism, the latter subject being dealt with in more detail than the former. Although a consideration of iron losses is included there is no mention of dielectric loss. The treatment of transients before the introduction to a.c. circuits is unusual but should give students a more fundamental approach to the a.c. circuit theory which is fully developed with worked examples. There is a short chapter on harmonics which has probably been limited to keep the volume to the required size. No doubt the same consideration accounts for the omission of thermionics and semiconductor theory. A number of problems follow each chapter with answers at the end of the book.

Although the work is primarily directed to the needs of the university student it should also find a useful place on the shelves of the technical college student and the practising engineer.—J.A.C.

**Welding Engineer's Handbook.** By J. A. Oates. Pp. 292; figs. George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2. Price 21s.

There have been many advances in welding techniques and equipment since the 8th edition of the "Welding Engineer's Pocket Book," now superseded by this handbook; was published. These include the development of the shielded-arc processes for both manual and automatic operation and the introduction of new equipment and improved types of electrodes. To incorporate these and other developments, this handbook has been completely rewritten and enlarged. A feature is the inclusion of a directory of metal-arc electrodes. The revision also provided an opportunity to add tables of data and machine settings, which increase the value of the book as a source of reference.

Certain subjects are common to more than one welding

process, and to avoid repetition these have been dealt with only once. The comprehensive index aids tracing the references to these subjects. The book is a guide to modern gas, arc and resistance welding techniques and equipments. Related processes are covered—such as electric and flame brazing, hard surfacing, metal cutting, bronze welding, cold-pressure welding, shielded-arc, atomic-hydrogen, thermit, stud, and automatic welding processes. Other sections are devoted to the causes and correction of distortion, weld inspection and testing, welding instruction, weld dressing, and British Standards.

**Sound and Television Broadcasting—General Principles.**

By K. R. Sturley. Pp. 382; figs. Iliffe Books, Ltd., Dorset House, Stamford Street, S.E.1. Price 45s.

The basic principles of sound and television broadcast engineering and operations are explained in this book, which is one of the B.B.C. engineering training manuals written primarily for new recruits to the B.B.C. engineering division. It is published by arrangement with the B.B.C. for *Wireless World* by Iliffe Books, Ltd. The introductory chapter deals with basic physical principles and their application to broadcasting. Other chapters follow on sound and television studios, telecine and telerecording. The topics covered include apparatus, techniques and procedures; outside television broadcasting, including "Eurovision"; amplitude and v.h.f. modulated transmitters; and the problems of conveying the sound and television programme frequencies and communicating between the various studio centres and transmitting centres.

**Thermodynamic and Isotope Exchange Functions.**

National Bureau of Standards Monograph 20. Pp. 271; figs. U.S. Government Printing Office, Washington 25, D.C. Price U.S.\$2.75.

This monograph contains a set of tables of thermodynamic properties of a large number of diatomic hydrides, deuterides and tritides for the ideal gas state at one atmosphere pressure. In addition to the thermodynamic properties of the molecular gases, the tables also include thermodynamic properties for chemical reactions involving the isotopic exchange of hydrogen. The properties tabulated are the heat capacity, enthalpy, Gibbs free energy, and entropy.

### BOOKS RECEIVED

**Electronics: A Bibliographical Guide** by C. K. Moore and K. J. Spencer. Pp. 411. Macdonald & Co. (Publishers), Ltd., 16, Maddox Street, London, W.1. Price 65s.

**High Voltage Distribution Practice.** Symposium edited by J. H. Grindley. Pp. 240; figs. Ernest Benn, Ltd., Bouverie House, Fleet Street, London, E.C.4. Price 45s.

**Operational Electricity.** By Charles I. Hubert. Pp. 530; figs. John Wiley & Sons, Ltd., Gordon House, Green-coat Place, London, S.W.1. Price 68s.

**Essentials of Radio-Electronics.** 2nd Edition. By Morris Slurzberg and William Osterheld. Pp. 716; figs. McGraw-Hill Publishing Co., Ltd., 95, Farringdon Street, London, E.C.4. Price 56s.



# PERSONAL AND SOCIAL

## News of Men and Women of the Industry

The Minister of Power has re-appointed **Sir Giles Loder, Bt., M.A., J.P.**, as a part-time member of the South Eastern Electricity Board.

**Mr. P. D. G. Heneker**, who for the past two years has been personal assistant to Mr. W. K. Brasher, secretary of the Institution of Electrical Engineers, has been appointed public relations officer of the Institution. Mr. Heneker, who is 30, was educated at Wellington College and Brasenose College, Oxford. He joined the I.E.E. staff in 1958 after spending four years with a British business house in Calcutta.



Mr. P. D. G. Heneker

The creation of this post is intended to strengthen communication between the Council of the Institution and the technological and lay public.

The General Electric Co., Ltd., announces the following appointments:—**Mr. T. C. Standeven**, appointed director of Radio & Allied Holdings, Ltd., and becomes general manager; **Mr. R. H. Pengelly**, appointed director of Radio & Allied Holdings, Ltd.; **Mr. P. R. Sanson**, appointed director of G.E.C. (Radio & TV) Holdings, Ltd.; and **Mr. K. Veseley**, appointed director of Radio & Allied Industries, Ltd. Radio & Allied Holdings, Ltd., is the holding company for Radio & Allied Industries (Sobell & McMichael) and G.E.C. (Radio & TV), Ltd.

**Mr. C. Garn** has been appointed sales manager of Epsilon Industries, Ltd. (Stone-Platt group), and **Mr. R. A. Edwards** works manager. Mr. Garn joined the company last year as chief sales engineer for magnetic tape recording equipment, having previously been with Clifford & Snell, Ltd., for over 20 years. Mr. Edwards was formerly production manager of Decca Radar.

**Mr. F. Winston Reynolds**, founder of Winston Electronics, Ltd., has relinquished his duties as chairman and managing director of the company, and will now devote the whole of his time to the exploitation of their new

range of fully transistorised loud-speaking telephones. **Mr. W. Allen Bridges**, who takes over as chairman and managing director, is the director of European operations of the Dynamics Corporation of America, of which Winston Electronics is a wholly-owned subsidiary, and is permanently resident in Britain. Mr. Reynolds remains a member of the board.

**Mr. Keith C. Huntley** has been appointed chief electronics engineer to Adrema, Ltd., and will be responsible for the formation and building up of their new Data Processing Division.

Associated Electrical Industries, Ltd., announce that **Mr. A. C. Ehrenberg**, Dip.Eng., A.M.I.E.E., has been appointed manager and chief engineer of the Switchgear Testing Co., Ltd., Trafford Park, and that **Mr. A. V. Sykes** has been appointed secretary of the company. These appointments follow the retirement of **Mr. V. A. Brown**, B.Sc.Tech., M.I.E.E., as manager and secretary of the company. Mr. Sykes retains his duties as chief clerk, Secretary's Department, A.E.I. (Manchester), Ltd.

Mr. Ehrenberg was born in South Africa and received his technical education in Switzerland. He joined the Metropolitan-Vickers Electrical Co., Ltd., in 1923 and became closely connected with the building of the A.E.I. test plant which, in 1934, commenced operation as the Switchgear Testing Co., Ltd. He was appointed engineer-in-charge and with the expansion of the company his position was later changed to that of chief engineer.

Mr. Brown received practical training with the British Westinghouse Electrical & Manufacturing Co., Ltd., forerunner of A.E.I. (Manchester), Ltd. He joined Ferguson Pailin, Ltd., in 1921 and was chief of the Research Department from 1923 to 1934 when

he was appointed manager of the Switchgear Testing Co.; he combined that office with that of secretary from 1946 onward. Mr. Brown was chairman of the Technical Committee of the Association of Short-Circuit Testing Authorities (ASTA) from 1946 until his retirement.

**Mr. G. Nuttall** has been appointed sub-area accountant of the No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, to succeed **Mr. H. Bagshaw**, recently appointed sub-area accountant at Sheffield.

**Mr. H. E. Bagnall**, of Edmundsons (Midlands), Ltd., has been appointed director and general manager of that company. He was previously a director of F. Westerman (Wholesale), Ltd., which joined the Edmundsons Group in 1957.



Mr. H. E. Bagnall

Research scholarships (valued at £500 per annum) have been awarded by the British Broadcasting Corporation to **Mr. J. Elliott** (Imperial College, London, for one year), **Mr. K. L. Hughes** (Birmingham University, for two years) and **Mr. B. J. Tilley** (University College of Swansea, for two years).

**Mr. V. C. Botham**, A.M.I.E.E., retired from the position of district engineer, Southern Electricity Board, Yeovil, on 31st August. Before nationalisation he was mains engineer at Yeovil with the Wessex Electricity Co. and previously he was for a time borough electrical engineer of Ruthin.

The finals of the **Electrical Industries National Golf Championship** will be played at Southport & Ainsdale and Hillside Southport Golf Courses on Monday, 2nd October. Apart from the final of the national championship there are also competitions for veterans and visitors. The



Mr. A. C. Ehrenberg



Mr. A. V. Sykes



Mr. V. A. Brown



annual dinner is to take place at the Prince of Wales Hotel, Southport, in the evening when Mr. R. B. Brown will be in the chair.

The Plessey Co., Ltd., has appointed **Brigadier J. D. Haigh, O.B.E., M.A.,**



Brig. J. D. Haigh

**M.I.E.E.,** as general divisional manager of a group of divisions including the Wiring and Connectors Division, the Capacitors and Resistors Division and Pre-formations, Ltd. Brigadier Haigh, formerly Director of Electronic Research and Development at the Ministry of Supply and one of Britain's early radar experts, joined the Plessey Co. in 1958 and since February last year has been divisional manager of the Capacitors and Resistors Division, Swindon.

**Mr. A. J. K. Parker, Associate I.E.E., M.I.Prod.E.,** managing director of F. H. Wheeler & Co., Ltd., has been elected chairman of the company in succession to **Mr. F. H. Wheeler**, who has resigned but remains on the board. Mr. Parker continues as managing director, a post which he has held since joining the company in 1952.

**Messrs. E. E. Fields, G. G. Kitchener, Associate I.E.E., and J. S. Smith,** who have been technical directors since 1956, have been elected to the board. **Mr. J. P. S. Edge-Partington, F.C.A.,** has also been elected a director and has been appointed secretary of the company.

**Mr. H. Bagshaw, A.I.M.T.A.,** has recently taken up the duties of sub-area accountant in the No. 3 (Sheffield) Sub-Area of the Yorkshire Electricity Board in succession to the late Mr. Ralph Longley. Mr. Bagshaw was formerly sub-area accountant in the Board's Grimsby Sub-Area and before moving to Grimsby in 1950 had served in the Bradford Sub-Area and with various local authorities.

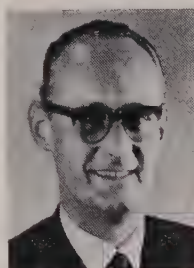
The Ministry of Aviation announces the appointment of **Dr. G. G. Macfarlane, B.Sc., A.M.I.E.E.,** at present Deputy Director of the National Physical Laboratory, as Director of the Royal Radar Establishment at Malvern. He will take up his new duties in the early part of next year.

Honeywell Controls, Ltd., announce the following appointments in their Electronic Data Processing Division:—**Mr. L. Dilger, B.Sc., A.M.I.E.E.,** tech-

nical sales manager; **Mr. M. Hare,** manager of applied programming; **Mr. J. Kenny,** manager of the E.D.P. Centre; and **Mr. H. La Costa,** commercial sales manager.

**Mr. Hector D. Walker** has retired from the board of Constructors John Brown, Ltd. He will continue to be associated with the company as a consultant and as a director of the subsidiary companies, Automatic Control Engineering, Ltd., and Corrosion & Welding, Ltd.

**Mr. J. C. Longman,** who has been appointed technical sales manager of Ekco Heating & Electrical, Ltd., joined Ekco as heating technical representative in 1950, covering the Eastern Counties and North London, and two years ago he became responsible for technical sales



Mr. J. C. Longman

## Sir William Cook at Electrical Industries Club

ABOUT 150 members and guests of the Electrical Industries Club attended the September luncheon meeting on Tuesday last. **Mr. E. A. V. Peckham,** president, was in the chair and the guest speaker was **Sir William Cook,** member for reactors, United Kingdom Atomic Energy Authority. Sir William gave an entirely personal résumé of the present situation on the peaceful uses of nuclear energy. Capital costs, he said, were still going down although the law of diminishing returns must still operate. The latest civil magnox stations ordered were likely to produce electricity at base load at a price per kWh which would approach that from conventional stations. Sir William was optimistic about the future of magnox stations, since he thought that current estimates were somewhat conservative, but this, he said, had yet to be proved. It was, however, far too early to speculate about the economics of advanced types of gas-cooled reactors. Sir William also referred to the fast reactor development at Dounreay, which was, he said, a necessary link in the economics of power production. Fast reactors would burn plutonium, which is produced in large quantities in magnox reactors.

The U.K. programme was, thought Sir William, soundly based and off to

liaison with Government Departments, Electricity Boards and public authorities. Mr. Longman is based at the company's new London offices, 41-47, Old Street, E.C.1.

## OBITUARY

**Lady Pickles.**—We regret to report the death, on 11th September, of Lady Pickles, wife of Sir John Pickles, chairman of the South of Scotland Electricity Board, to whom we extend our deepest sympathy.

**Mr. J. H. Blackmore, Associate I.E.E.,** Kent sub-area engineer of the South Eastern Electricity Board, died on 6th September at St. Bartholomew's Hospital, Rochester, following an illness of some three months' duration. Mr. Blackmore, who was 54, was born at Devizes and spent the whole of his business life in Kent. He served his apprenticeship with the Kent Electric Power Company from 1923 to 1928 and subsequently held a number of appointments in that organisation, culminating in his appointment in 1943 as regional mains engineer. He became Kent sub-area engineer in 1948.

a fair start. Referring to the American water-cooled reactor programme, he felt that developments were not far enough advanced to be able to compare the economics with the U.K. gas-cooled types. In conclusion, Sir William discussed the problem of dwindling stimulus. The original stimulus was due to military requirements, but he felt that a similar stimulus was needed in peacetime.

Following a vote of thanks to the speaker, Mr. Peckham announced that the next luncheon would be held on Tuesday, 10th October, when the guest speaker would be **Mr. S. J. Emerson,** Senior Electrical Inspector of Factories.

## Electrical Engineers' Exhibition Dinner

Many distinguished men will be among the 800 people expected to attend the Electrical Engineers' Exhibition dinner at Grosvenor House, London, W.1, on 28th September. **Mr. R. F. Mathieson,** chairman of the Exhibition Company, will preside and will announce the 1962 Exhibition special feature—"Electricity in Aviation." The speakers will be Air Marshal Sir Herbert Spreckley, Sir Charles Westlake and Sir William McFadzean.

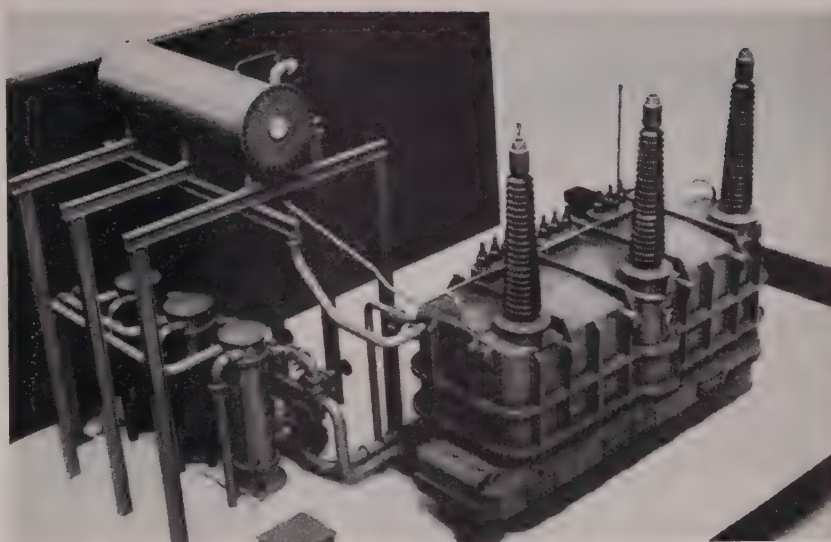


## INDUSTRIAL NEWS

### LARGE GENERATOR TRANSFORMERS

AN order has been received from the Central Electricity Generating Board by Ferranti, Ltd., for four 570 MVA 22/430 kV three-phase delta-star, 50 c/s, double-wound generator-transformers for West Burton power station. These are the largest units so far ordered and the total cost will exceed £1 million. Ferranti high-speed resistor transition on-load tap changing gear will be fitted to cater for voltage variations of  $\pm 10$  per cent in 18 steps. Cooling will be by means of forced-oil circulation through oil/water heat exchangers.

The cores of the 570 MVA units will be of the minimum bolted, five-limb backbone construction, employing full  $45^\circ$  mitring of all joints, thus ensuring minimum core loss and minimum magnetising current. The five-limb core construction will be used to bring the units within permissible



Scale model of one of the Ferranti 570 MVA 22/430 kV transformers ordered for West Burton

loading gauges, and core clamps and tanks will be of aluminium to bring the weight within transport restrictions. The weight of each complete

transformer stripped for transport will be kept down to 215 tons, and dimensions will be 32ft 6in long by 13ft 6in wide and 16ft 2in high.

#### Kent Railway Electrification

Electric trains will be running on all the principal lines in Kent from 9th October—eight months ahead of schedule. They have been operating on the London - Ashford - Dover main line and the branch line between Paddock Wood and Maidstone West since June. Next month they will also work from Maidstone East to Ashford and from Ashford to Ramsgate via Canterbury. Full modernisation of these lines, however, will not be completed until June, 1962. Until then the electric trains will continue to run at the same times as the steam trains they are replacing because of engineering and colour-light signalling work.

#### IRISH STRIKE OVER

The strike of electricians in the Irish Republic, involving mostly the State Electricity Supply Board, has ended. An offer of 10d per hour was accepted by 1,400 votes to 400—the men had asked for 1s 2d an hour. The strike lasted for eighteen days during which a special meeting of the Dail was held when a Bill was passed to deal with the situation if a crisis should arise. The Bill is now "dead," save for the setting up of a tribunal to inquire into other features of Electricity Board work.

### Cable under the Thames

A CABLE laying contract worth £100,000 is being carried out by the Construction (Cables and Lines) Division of Associated Electrical Industries, Ltd., between West Weybridge in Surrey and Laleham in Middlesex. It involves laying 33 kV oil-filled power cable and associated pilot cables across the River Thames in pipes buried in a trench dredged across the river bed just below Chertsey Bridge. The dredging and pipe laying operation was recently carried out. Four 6in diameter steel pipes were bracketed together and floated into position across the

river. The oil drum floats were then cut away and the pipes sank into the excavated trench, to be covered later with bags of concrete.

The contract is being carried out for the South Eastern Electricity Board to reinforce the electricity distribution system between substations at West Weybridge and Laleham. Two canal crossings are also involved where the same method of laying the cables is being employed. The river excavation work was carried out by the Dredging & Construction Co., of King's Lynn, Norfolk.

### Consumers and Sales

The analysis of electricity sales in the second quarter of the year issued by the Electricity Council shows that there was little change in the relative position of industrial and domestic consumers, in both of which classes the rate of increase was lower than in the corresponding quarter of 1960.

Traction supplies, however, improved by 6.6 per cent against 1.5 per cent and public lighting by 10.5 per cent (6.8 per cent).

The return relates to Area Boards in England and Wales and the figures to kWh metered or billed during the period concerned.

Class	Three months ended 30th June Million kWh	Increase over similar period of previous year %	Twelve months ended 30th June Million kWh	Increase over similar period of previous year %
Domestic ... ..	8,827.8	+11.5	32,545.6	+16.3
Farm ... ..	473.1	+7.5	1,825.7	+17.1
Commercial ... ..	3,057.3	+7.2	12,108.6	+12.5
Combined Domestic/Commercial ... ..	425.7	+7.8	1,607.1	+12.2
Industrial ... ..	11,801.3	+5.6	47,405.6	+7.0
Public Lighting ... ..	162.4	+10.5	804.8	+8.9
Traction ... ..	391.4	+6.6	1,600.3	+3.0
TOTAL ... ..	25,139.0	+7.9	97,897.7	+10.8



## INDUSTRIAL NEWS [continued]

**B.E.A.M.A. PUBLICITY CONFERENCE**

THE sixth B.E.A.M.A. publicity conference will be held on Tuesday, 7th November, and Wednesday morning, 8th November, at the Connaught Rooms, London. The Hon. H. G. Nelson, managing director of the English Electric Co., Ltd., will be the guest speaker at a formal luncheon on the Wednesday. Mr. G. M. C. Peacock, chairman of the B.E.A.M.A. Publicity and Exhibitions Committee, will be the conference chairman.

The underlying theme of the conference will be the ever-increasing importance of publicity in the overall marketing operation at home and overseas, and the subjects of the six sessions are expected to be: The Company Image: Its Creation and Value; Letterpress or Litho for Trade

and Technical Literature; Publicity Overseas; A Discussion Session: "What Would You Do?"; The Law in Relation to Advertising; Publicity: Vital Ingredient of Marketing.

Delegates to the conference will be guests of the Associated Television Studios on the Tuesday evening, when visits will be made to studios at Elstree and Wood Green.

**Lighting the "Canberra"**

Messrs. G. Carter and A. E. Fothergill, the authors of the article "Lighting the *Canberra*," which appeared in last week's issue, are with the Lighting and Heating Group of the General Electric Co., Ltd.

**T.U.C. Opposes "Wage Pause"**

THE most important and serious debates last week at the Trades Union Congress were on two motions, one from the Civil Service unions on the "wage pause" and the other on the economic situation. Both were carried. The Civil Service unions' motion declared that the intervention by the Government in the normal processes of collective bargaining would undermine the confidence of workers generally in the peaceful settlement of industrial disputes. Mr. Frank Cousins (general secretary, Transport and General Workers' Union) gave a warning that strikes might result if justifiable claims were resisted.

The resolution on the economic situation expressed concern at rising prices, loss of exports, and "the failure to plan in order to increase production." Before this was put to Congress Mr. Harry Douglas (general secretary, Iron and Steel Trades Confederation), speaking for the General Council, said the Chancellor of the Exchequer had given those trade union leaders who had consistently advocated civilised methods of settling disputes by arbitration rather than strike a slap in the face and had encouraged the advocates of direct action. He indicated, however, that the General Council would co-operate in economic planning.

In a composite motion, Congress again called for a forty-hour week.

A further resolution, introduced by the Amalgamated Engineering Union and the Amalgamated Union of

Foundry Workers, complained of the inferior treatment of manual workers in the field of industrial conditions and called upon all trade unions to secure agreements for a minimum of three weeks' annual holiday and eight statutory holidays.

**Evershed Reorganisation**

A number of changes have been made in the Instrument Division of Evershed & Vignoles, Ltd., under the divisional manager, Mr. H. A. Challinor. The range of "Megger" products has been "streamlined" to permit greater concentration on the more important and popular models and a number of new instruments are planned for production in the future. Mr. R. M. Wardrop, previously Scottish area manager, is now in charge of home sales. Greater emphasis will also be placed on exports. In support of this, Evershed's are exhibiting at Utrecht, Brno and other technical fairs throughout the world, as well as at international shows in London.

**VALVE AND TUBE DISTRIBUTION**

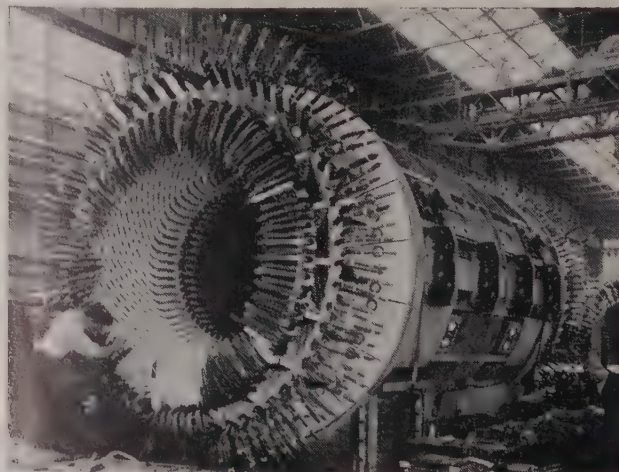
Distribution of Mazda valves and cathode ray tubes (manufactured and marketed by Thorn-A.E.I. Radio Valves & Tubes, Ltd.) is now undertaken by the Mazda Commercial Division of the Thorn-A.E.I. company. A.E.I. district offices, through which distribution was formerly carried out, no longer hold stocks. Orders from wholesalers should now be addressed to the Valve Order Office, Thorn-A.E.I. Radio Valves & Tubes, Ltd., 155, Charing Cross Road, W.C.2.

**200 MW Generators for Kincardine**

THE stators of the two 200 MW generators which the General Electric Co., Ltd., is supplying to the South of Scotland Electricity Board for Kincardine "B" power station will have water-cooled windings. Each stator conductor comprises a number of thin-walled but robust rectangular copper

tubes and solid copper strips. Water enters the tubes through the main terminal bushings and leaves from only six points on the winding end turns. All pipework is metallic with brazed joints. The stator core is spring mounted to eliminate transmission of vibration to the machine foundations.

Stator of 200 MW G.E.C. generator for Kincardine power station





# GET TO GRIPS WITH STATIC

## and speed up production



Problems of static electricity vary immensely in the form they take, from dust problems on plastics and textiles, to processing difficulties whilst converting paper, plastics and textiles. Whatever the problem it reduces production efficiency and often product quality. Morale is invariably lowered, expensive machine stoppages increased and customers upset or disappointed. Each time static occurs, wastage and costs are increased. Each time a decision on its removal is postponed, the losses mount. The extra costs incurred over a year, whether the problem be serious or not, are high and unnecessary.

As specialists with a complete service in static elimination it is our aim to help you. From our many years experience we can advise on your problem quickly and surely—with our wide range of products supply the correct answer. Reliable tested products which are used throughout the world. It is our aim to help you—to remove your problems—return your process to maximum efficiency—to save you money and worry.

All enquiries to :—  
Norman Abbott  
Technical Sales Director  
or  
M. G. Matthews  
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LONDON, S.W.4  
Telephone : MACaulay 4555



# NEW

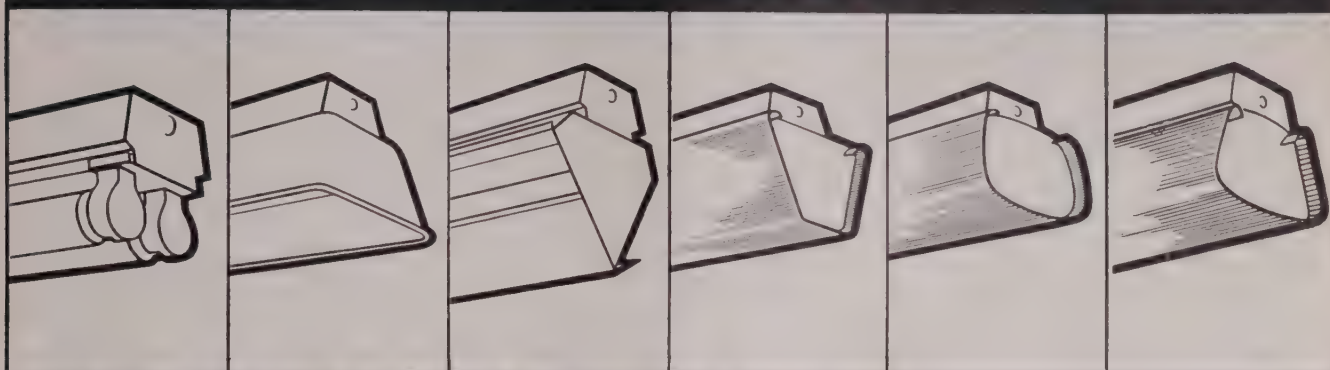
# DURHAM

RANGE

## LIGHTING FITTINGS







a complete and compact range

- \* Switchstart and quickstart throughout range
- \* Easy installation and maintenance
- \* Superbly engineered

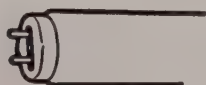
PRODUCED BY

**EKCO**

- \* Competitive price
- \* Quality materials and manufacture
- \* Wide range of quick-fix reflectors and diffusers

**LIGHTING ADVISORY SERVICE**  
Ekco-Ensign operates a Lighting Advisory Service throughout Great Britain. Qualified Lighting Engineers will be pleased to call on you, discuss your particular problem and to prepare detailed lighting schemes. This service is entirely free and without obligation.

## EASY ASSEMBLY AND MAINTENANCE



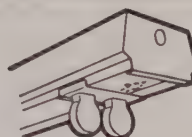
**Tubes**  
For 8 ft., 5 ft. & 4 ft. single and twin.  
Also 85W 8 ft. twin.



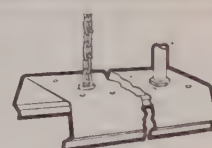
**Spine**  
Identical strong shallow section for all tube sizes—single and twin.



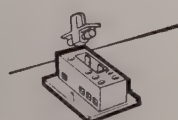
**Packing**  
All fittings separately cartoned. Lampholder platforms ready-wired packed in spine.



**Lampholder Platform**  
Platform locked into position without tools. Lampholders cannot be reversed on twin fittings.



**Installation**  
For chain, conduit or direct-on-ceiling. Knockout at centre and in endplates.



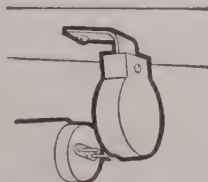
**Fused Terminal Block**  
3-way block for fitting protection—easily replaceable B.S. cartridge fuse.



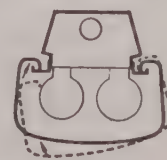
**Starter Switches**  
Instantly accessible without dismantling fitting.



**Reflectors & Cover Plates**  
Quickly and easily attached by a simple locking device.



**Lampholders**  
White, plastic, sprung, bipin for positive operation.



**Diffusers**  
Positively attached to spine by simple swing-over action.

**EKCO-ENSIGN ELECTRIC LIMITED.** 45 Essex Street, Strand, London WC2 Telephone: CITY 8951

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# INTOL IN CABLES

INTOL for insulation and sheathing. INTOL for light and heavy duty flex. INTOL gives excellent abrasion resistance and tear strength with high tensiles and good ageing properties. INTOL is consistent in quality, stable in price and punctually delivered from stock. I.S.R.'s Technical Service is at the call of manufacturers at any time to test and advise on specifications for all grades of INTOL.



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INDUSTRIAL NEWS *[continued]***BOARD'S POLICY ON OVERHEAD LINES**

THE chairman of the East Midlands Electricity Board (Mr. Nevill Marsh) told the Area Electricity Consultative Council at Nottingham last week that the Board would be prepared in certain circumstances to place small sections of its overhead distribution lines underground.

The kind of improvements which the Board had in mind would deal with such matters as (a) lines which were erected many years ago and did not conform to modern standards of design and construction; (b) lines which had been badly sited and which stood out obtrusively on the skyline in undulating country; and (c) pole or ground-mounted transformer installations which had become unsightly because of subsequent road or other development works.

It was possible that in some localities where the demand for electricity had outgrown the capacity of the original distribution system the existing overhead lines would be replaced in due course by underground cables. The Board would also be prepared to co-

operate with local authorities on a cost-sharing basis in the undergrounding of small sections of overhead lines in particularly attractive villages even though the present overhead lines were satisfactory from an electricity supply point of view. One improvement scheme had already been agreed and now awaited the approval of the Ministry of Housing and Local Government. It covered the undergrounding of six spans of overhead line in the centre of the village of Stanwick, near Higham Ferrers. The total cost of the work was approximately £1,300, of which the North-

amptonshire County Council had agreed to contribute one-third. This scheme, though small in itself, was a step in the right direction and it was possible that two or three others would be undertaken each year.

Landlords were becoming increasingly reluctant to grant wayleaves for transmission lines, especially when their land was already crossed by electricity lines. A small part of the Board's 11 kV network might eventually have to be placed underground in order to make way for the higher voltage lines, but the Board had no intention of starting any large-scale programme for the undergrounding of its 11 kV lines. This could be justified only if its effect on electricity tariffs was marginal.

**Diesel-electric Locomotives for Rhodesia**

AN order worth about £1,300,000 for sixteen diesel-electric locomotives has been awarded to the English Electric Co., Ltd., by Rhodesia Railways. The locomotives, each of 1,875 h.p., are similar to 35 already supplied by the company, one of which recently established a record of 14,062 miles in a month.

These locomotives, which have a 1-Co-Co-1 wheel arrangement, are designed for 3ft 6in track gauge and operate on a railway having gradients and curves which combined with altitude and high ambient tempera-

tures produce onerous operating conditions. Similar locomotives have already been supplied to the East African Railways and Harbours.

The Brush Electrical Engineering Co., Ltd., is to supply 14 main-line diesel-electric locomotives to the Rhodesian Railways, under a contract worth approximately £1,250,000. The new locomotives will be powered by Mirrlees JVS12T 12-cylinder diesel engines, fitted with HSBT turbochargers and developing 1,730 b.h.p. under the climatic conditions in Rhodesia.

**Educational**

The Institution of Plant Engineers is holding a refresher course for works and plant engineers at the Institution of Engineers and Shipbuilders, Elmbank Crescent, Glasgow, commencing on 1st November.

Leaflets giving details of courses of lectures on a variety of subjects are available from the Sir John Cass College, Jewry Street, Aldgate, London, E.C.3.

The one-year course in "Corrosion and Protection of Metals" introduced last year at the Borough Polytechnic, London, S.E.1, is to be repeated this year.

**Modern Shop Lighting**

A COMBINATION of fluorescent tubes behind translucent plastic diffusers and tungsten lamps in black and white pendant fittings is used in this section of the Horne's store at Southend (see below left). Lighting of the modernised shop was carried out by Courtney, Pope (Electrical), Ltd.

In the Russian shop in Holborn (right) Merchant Adventurers' new

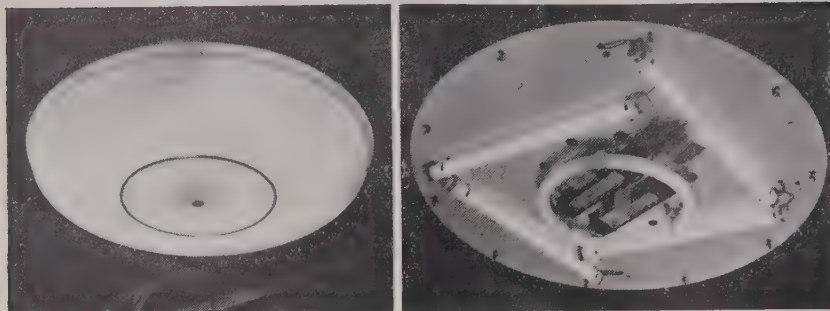
range of "Drum" and "Ellipse" fittings are used. The "Drum" fittings, which are available from 5in to 18in in diameter to take 40 to 200 W lamps, have concentric diffusers of opal urea formaldehyde which give a cut-off of 45°. The "Ellipse" fittings, in opal glass, are available in five sizes and many forms from 10in to 22in for 40 and 300 W lamps.





## INDUSTRIAL NEWS [continued]

## Lighting Fittings for Ships



This ship's lighting fitting originally designed to house ten 60 W tungsten lamps has been adapted by Heaton Tabb & Co., Ltd., to take one Philips 40 W circular fluorescent tube and four 2ft 40 W straight tubes with their associated control gear. A smaller fitting for three 60 W tungsten lamps has been similarly adapted to take a single circular tube

## HAIR DRYERS TESTED

THE September issue of *Which?* published by the Consumers Association, Ltd., contains a test report on twenty different electric hair dryers. Clauses of the British Standard 3296 for domestic electric hair dryers were used to conduct tests for the electrical safety of the dryers and only one was found to be completely satisfactory electrically—all the others had defects. None, however, was considered dangerous, and only one had enough serious faults for it to be considered potentially dangerous. The remainder were considered to be reasonably satisfactory in normal use but it was stated that there was obviously scope for considerable improvement in the level of electrical design.

None of the dryers tested claimed to conform to B.S. 3296, possibly because the Standard was issued only in 1960 and manufacturers were not yet marketing dryers to meet its requirements. The *Which?* report concludes with the hope that future models, inspired by the Standard, may be electrically better designed than the ones tested.

The British Standards Institution has appropriately enough just issued another section of B.S. 3456:1961

("Testing and Approval of Domestic Electrical Appliances") which covers electric hair dryers. This section, B.4, replaces B.S. 3296 and is concerned with the electrical and mechanical construction in so far as these affect safety, durability and reliability in service. It does not deal with performance.

All hair dryers claimed to comply with Section B.4 of B.S. 3456 must bear the certification mark of the British Electrical Approvals Board for Domestic Appliances and the mark may be used only under licence from the B.E.A.B.

Copies of Section B.4 of B.S. 3456 may be obtained from the B.S.I., 2, Park Street, W.1, price 5s each.

## T.I. Acquires Durham Factory Site

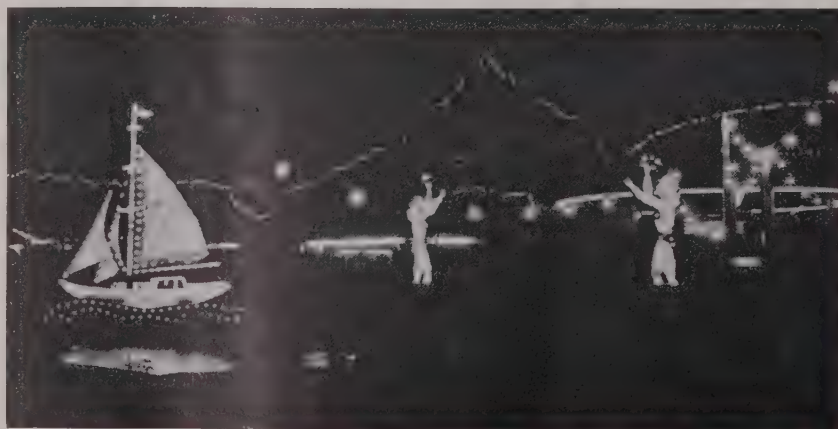
THE acquisition of a 280-acre site at Washington, Co. Durham, for the long-term development of its manufacturing capacity is announced by Tube Investments, Ltd. The decision has been taken after full consultation with the Board of Trade, the local authorities and the district officials of the trade unions concerned. It is expected that preliminary site work will begin early next year and that by 1965 some 750 men and women will be employed in the manufacture of steel tubing.

The first factory will house a highly mechanised electric resistance welded tube mill incorporating many advanced engineering features. Subsequent factories will be erected in accordance with a development programme for the production of steel tubes and other T.I. products. The ultimate labour force is expected to exceed 3,000.

## Clean Air Conference and Exhibition

Nearly 1,000 members and delegates will be attending the 28th Conference of the National Society for Clean Air, to be held at Brighton from 4th to 6th October. The conference will be opened by the Parliamentary Secretary to the Ministry of Power, Mr. J. C. George. A special feature this year will be a transatlantic telephone discussion between a panel of experts, under the chairmanship of Sir Hugh Beaver, at Brighton and a panel in New York.

## DECORATIVE ILLUMINATIONS AT BARRY ISLAND



The seaside resort of Barry Island, in the South Wales Electricity Board's area, already noted for its fine sands and safe bathing, has this year embarked on a scheme of illuminations which it is ultimately hoped will make it the "Blackpool of Wales." From the photograph it will be seen that a promising start has been made with this venture which it is intended to extend progressively each year. The Board, in co-operation with the borough engineer and the local traders' association, has been responsible for the design and erection of the illuminations

## Foundry Electricity Conference

"Electricity in the Foundry," a two-day conference organised by the Midlands Electricity Board, will be held at Wulfrun Hall, Wolverhampton, on 10th and 11th October. Subjects for discussion include arc and induction furnaces, industrial electricity tariffs, and materials handling, automation and amenities in the foundry.



## Volga Hydro-Electric Scheme

The new Stalingrad hydro-electric power station was officially opened by Mr. Krushchev last Sunday. It has a total capacity of 2,500 MW, from twenty-two 115 MW machines, and will generate 11,000-14,000 million kWh per annum. Behind the three-mile long dam across the Volga, which carries a road and a railway, a 375 sq mile lake has been formed. The station supplies electricity to the Moscow area by a 650 mile 500 kV line. An 800 kV d.c. line is being constructed from the station to the Donbas.

## "SON ET LUMIÈRE" AT DOVER

Dover Castle is the subject of the latest *Son et Lumière* production in England. Dover Operatic Society, with the support of Dover Corporation, were responsible for the script, sound track and production, and lighting effects were provided by Atlas Lighting, Ltd., using their "Aurama" technique. The script commences with a 1940 air raid and the story of the Castle is then told through a series of "flashbacks" linked together by the voice of the "Spirit of the Castle" talking to a sentry.

A second attraction at Dover this year is a new fountain on the promenade which uses colour-change fluorescent lighting. Sixteen specially constructed fittings are used, each housing three 5ft 80 W tubes. The Atlas lighting units are controlled by a thyatron dimmer which produces a variety of sequences by transposition of the colours on different sections of the fountain.



Part of Dover Castle, the subject of a "Son et Lumière" production

## TRADE ANNOUNCEMENTS

Separate sales forces have been set up for **Morphy-Richards (Cray), Ltd.**, and **Morphy-Richards (Astral), Ltd.**, in view of the expansion and diversification of the group's products. The Astral sales force will concentrate on absorption and compressor refrigerators and spin dryers, and the Cray sales force will specialise in rotary ironers and vacuum cleaners in addition to the wide range of smaller appliances.

Three regional sales managers have been appointed to co-ordinate the Astral sales activities. They are Mr. D. S. Reid, North Region sales manager, 116, West Campbell Street, Glasgow, C.2 (telephone: Glasgow Central 1997); Mr. R. E. Milledge, Midlands Region sales manager, Ronlyn, Church Road, Snitterfield, nr. Stratford-on-Avon (telephone: Snitterfield 380); and Mr. G. E. Johnson, South Region sales manager, 50, Conduit Street, London, W.1 (telephone: Regent 4080).

Two new area managers have been appointed by Morphy-Richards (Cray), Ltd. Mr. W. K. McCandlish, who becomes Scottish area manager, will operate from 240, Darnley Street, Pollockshields, Glasgow, S.1 (telephone: Pollock 1964), and Mr. D. J. Wellington, Yorkshire and North East England area manager, from Whitehorse Buildings, 7/15, Whitehorse Street, Boar Lane, Leeds (telephone: Leeds 24070).

The **Sofono Electrical Division of Federated Foundries, Ltd.**, has appointed Mr. Robert V. Fisk and Mr. W. R. Lonsdale as area sales representatives. Mr. Fisk, who was previously with S. N. Bridges & Co., will be covering the South Western counties and Mr. Lonsdale, formerly with the Simplex Electric Co., Ltd., will operate in the North of England.

**Livingston Laboratories, Ltd.**, have appointed Mr. G. C. Warburton as field engineer to cover the Southern Counties and South London. After a period in the company's laboratories he will take up his duties on 1st November.

**Tung-Sol Electric Inc.**, New Jersey, U.S.A., have appointed **Walmore Electronics, Ltd.**, as their distributors in the United Kingdom.

The address of the London sales office of **Rowlands Electrical Accessories, Ltd.**, is now Regent House, 89, Kingsway, W.C.2 (telephone: Holborn 3361). Mr. G. Gardner, who for

some years has been sales representative in the North Western area, has been appointed to succeed the late Mr. J. L. Hill in the London area. Mr. E. W. Bailey has been appointed sales representative in the North Western area.

The office of the **A.E.I. Lamp & Lighting Co., Ltd.**, at 17, Grosvenor Street, Cheltenham, has been moved to Merchants Road, Gloucester (telephone: Gloucester 27663).

**Aero Electronics, Ltd.**, Gatwick House, Horley, Surrey, have been appointed the sole United Kingdom distributors for the United Transformer Corporation, New York.

The **M.C.B. Co. (Manchester), Ltd.**, has appointed Mr. S. T. Gregory to represent the company in South Wales and the South-West. For the past twelve years Mr. Gregory has represented George H. Scholes & Co., Ltd., and he was previously with the B.T.H. Co. at Cardiff.

**George Kent, Ltd.**, have opened an office at Lloyds Bank Chambers, Earl Street, Sheffield, 1 (telephone: Sheffield 77471). The branch is under the supervision of Mr. H. E. Farrar, area manager, assisted by Mr. G. H. Sharp, senior sales engineer.

The following branch management appointments have recently been made by **Brown Brothers, Ltd.**:—Croydon, Mr. S. J. Hillier; Sheffield, Mr. W. R. Tait; Bournemouth, Mr. J. Harding; and Aberdeen, Mr. J. T. Neil.

**Relax Domestic Appliances, Ltd.**, have moved to larger premises at 85, Carnwath Road, Fulham, where their new showrooms, offices and workshops will all be under one roof. The telephone number is Renown 2245.

**Atlas Lighting, Ltd.**, have appointed Mr. J. E. Wooldridge as sales supervisor for their South Western area.

## RAILWAY CABLING CONTRACTS

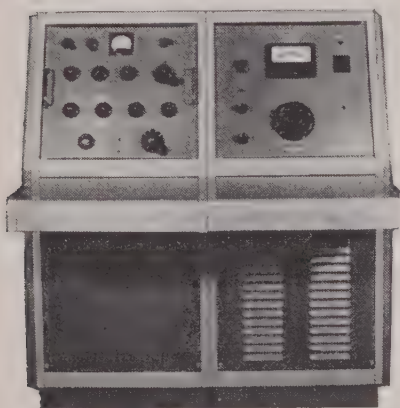
Cabling contracts worth £214,000 have been awarded to Associated Electrical Industries, Ltd., by the British Transport Commission. One of them is in connection with railway electrification renewal work between Kilburn, Camden and Broad Street and the other is associated with power supplies for signalling on London suburban electric railway lines from Charing Cross, Victoria and Cannon Street stations.



## NEW ELECTRICAL EQUIPMENT

### CAPACITANCE BRIDGE

A new 40 kV capacitance bridge announced by the INTERNATIONAL GENERAL ELECTRIC CO. OF NEW YORK, LTD., 296, High Holborn, London, W.C.1, is part of a range which is



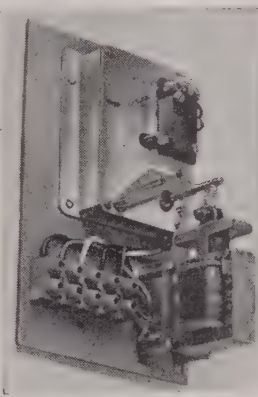
International General Electric capacitance bridge

available in mobile or stationary consoles and is designed to measure capacitance, dielectric losses and the dissipation factor of insulation and insulated apparatus such as bushings, power cables, transformers, generators, motors and switchgear. Capacitance measurement is accurate to 0.2 per cent and dissipation factor measurement to 0.01 per cent. Both characteristics can be read directly without calculations, and circuit arrangement permits easy self-checking without having the test sample connected to the bridge. An automatic guard circuit increases the speed of operation and ensures accurate readings, while a transistorised null detector reduces maintenance and gives longer battery life.

### TIME DELAY SWITCH

The automatic switching mechanism, type MES/100, introduced by the INDUSTRIAL INSTRUMENT SERVICES CO., Elkington Street, Aston, Birmingham, 6, has a solenoid operated mechanical escapement which operates a change-over switch at the end of an adjustable time delay. When energised, the solenoid loads a tension spring in the escapement mechanism, thus starting the delay period, at the end of which

a striker lever operates a changeover micro switch, the contacts of which can be used for various control requirements. De-energising the solenoid immediately resets the relay and the operation can be repeated at once if required. Instruments can be sup-



Industrial Instrument Services time delay switch

plied with manually adjusted time settings over the ranges 0-10, 0-30, 0-60 and 0-120 sec and 0-5 min. The switching capacity is 5 A at 230 V, 50 c/s with a non-inductive load, and the standard operating voltages are 100/110 V, 200/250 V, 400/440 V, at 50 c/s. Units for d.c. can be supplied to special order.

### POSITIVE ACTION RELAY

A relay technique ensuring positive make of relay contacts even when contact voltage is low and contacts have become contaminated with surface film has just been introduced by the Weston Instruments Division of DAYSTROM, LTD., Bristol Road, Gloucester. The "MagTrak" contact pressure aiding feature consists of the addition of a soft iron bead on the moving pointer and a permanent bar magnet assembly on each adjustable index arm. When the pointer reaches the control point, the bar magnet pulls in the pointer and moving contact against the flexible index arm contact with a rapid snap-wipe action. The force—of the order of 20 to 40 mg—is sufficient to overcome contact films, even at low contact voltages. In addition to the increased pressure provided to physi-

cally break existing high resistance films that form on the contacts, the quick, positive contact reduces transient arcing and so increases contact life.

The first use of the new principle has been made in the Model 1073 "MagTrak" relay. As in standard load-current-contact-aiding relays, this carries one relay contact on the pointer of the instrument and the mating contact on a flexible platinum-iridium strip attached to an adjustable index arm. The moving coil of the metal relay has an additional winding isolated from the sensing winding which is placed in series with the load when the contacts are closed. Current passing through the load also goes through the additional winding and produces a force of about 1 to 3 grams. This ensures a firm, positive make and causes compression of the flexible contact on the index arm.

The contacts, once made, must be reset by an interrupting technique. A pushbutton switch, mounted on the front of the case, is used to break the current through the meter locking winding. When the current is broken, the force against the compressed flexible contact is relaxed and the spring kicks away the moving contact with sufficient force to override the permanent magnet.

### TOROIDAL ARC WELDER

A new version of the "Fararc" toroidal arc welder, the Series III, has been introduced by PORTABLE WELDERS, LTD., Castle Mills, Buckingham. Grain orientated silicon steel is used for the transformer core, the windings are of double glass covered copper, the insulation is of asbestos and glass cloth, and the whole transformer is triple vacuum impregnated with silicone varnish. The transformer is fan cooled, and there is an automatic thermostatically controlled cut-out which, in the event of overheating, cuts off the welding current but leaves the fan running. The set cools down rapidly and when the correct temperature has been reached the thermostat switches in the main current again.

The unit has a current range from 60 to 300 A, with a continuous rating



Telephone Manufacturing Co. illuminated push button key



of 200 A. Power factor varies between 0.8 and 0.9, and the magnetising current is 80 mA. The equipment weighs only 90 lb, and is contained in an all-steel case measuring 14 in cube. Louvres at the back and front allow free passage of forced air over the windings. A black "Tufnol" ring is rotated to expose seventeen different secondary tapings. There are two carrying handles at the sides, and the unit is mounted on four rubber feet. A primary entry at the back measuring 6 in by 4 in facilitates a change of the copper busbars to give 200/250 V or 400/440 V running. The price of the Series III unit is £92 10s.

accuracy of ten parts per million (two seconds of arc absolute angular accuracy), low effective series impedance and negligible loading error. When driven by a suitable signal source, these standards provide stator outputs corresponding to those of a master synchro as its shaft is rotated in 5° increments through 360°. The standards are, respectively, intended to simulate rotor voltages of 26 V, 115 V and 115 V; stator voltages of 11.8 V, 90 V and 90 V; and frequencies of 400 c/s, 400 c/s and 60 c/s; they have effective series impedances of 0.01 Ω, 0.05 Ω and 0.15 Ω.

#### MOVING COIL RELAY

A series of relays is being marketed in this country by L. E. SIMMONDS, LTD., Byron Road, Harrow, now appointed sole concessionaires in the United Kingdom and Commonwealth for relays made by A. le Boeuf et Fils, of Colombes, France. In the moving coil relay type SB 21 the operating current may be as low as 1 μA with a 21 kΩ coil or as high as 10 mA with a 0.3 Ω coil, according to the type of coil winding used. A rectifier or a thermocouple may be incorporated to enable it to be used on alternating currents of almost any frequency. The coil may be double-wound, providing differential deflection, and this type may also operate according to a logarithmic law so that the two currents are multiplied or divided. The movement may be end or centre-stable and the contacts may be either 1 make plus 1 break or 2 make. The positions of the moving contact and the variable fixed contacts are shown by pointers in a normal meter scale on the top of the relay,

the fixed contacts being set by two adjusting screws adjacent to the scale. Insulation of the movement and the contacts from the frame is flash-tested to 500 V and the insulation resistance exceeds 10,000 MΩ. The instrument is housed in a cylindrical metal case 3½ in long by 1½ in diameter and is arranged to plug into a standard international octal valve-holder.

#### ILLUMINATED PUSH BUTTON KEY

An illuminated push button key for any light current switching duty is now available from the TELEPHONE MANUFACTURING CO., LTD., Martell Road, West Dulwich, London, S.E.21. It can be supplied in locking, non-locking and interlocking forms, and has applications in communications and data processing equipment as well as in test or control equipment where maximum contact loads do not exceed 300 mA at 100 V. The keys can be supplied with round or rectangular push buttons in black or white nylon, and for single, two-, ten-, or twelve-way key strips. A telephone type lamp is incorporated in the push button body and lamp illumination lenses can be in any of five colours. Twin silver contacts are used on all springsets—which are available as two or four change-over actions. The overall dimensions are 2½ in by 19/32 in by 1½ in, and the minimum mounting centre distance between keys is ⅝ in.

#### "HIDUTAC" SWITCHES

A series of "Hidutac" switches is now being introduced by the GENERAL ELECTRIC CO., LTD., Installation Equipment Group Headquarters, Four Ashes, Wolverhampton, to supplement its range of "Hidutac" switchfuses. The 15 A and 30 A models of both enclosed and cubicle-mounting types are already in production, and a 60 A model will be on sale in October. All types are t.p. and n. for operation up to 440 V. These switches will break eight times their rated current and have a high fault current duty. The prices are £1 8s 6d for the 15 A model and £1 13s for the 30 A unit. Adaptors for mounting the switches above or below busbar chambers can be supplied.

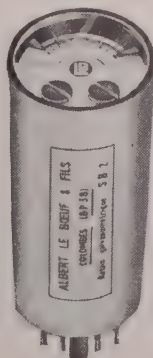
#### SYNCHRO STANDARDS

The three Gertsch synchro standards, designated SS-1, SS-2 and SS-3, now available from WAYNE KERR LABORATORIES, LTD., 44, Coombe Road, New Malden, Surrey, have a ratio



Wayne Kerr-Gertsch synchro standard

Moving coil relay type SB 21 marketed by L. E. Simmonds, Ltd.



#### TRANSISTOR POWER SUPPLIES

The range of low voltage transistor power supplies manufactured by J. LANGHAM THOMPSON, LTD., 176, High Road, Bushey Heath, Herts., has been extended by the introduction of units with ratings of 20, 30 and 60 VA. These can be mounted in groups of five, four and three respectively behind standard 19 in panels. A perforated metal case gives protection where bench operation is desired. All units are fully protected against short circuit and overload by electronic circuits and in the case of the 30 VA units re-setting is automatic when the overload is removed. Fixed voltages between 5 and 60 can be provided at currents determined by the maximum VA ratings of the three basic ranges



and a  $1\frac{1}{2}$  A unit permits continuous voltage variation between 4 and 12.5 V. The output, which is free from transients, contains only 1 mV r.m.s. of ripple and the source impedance is as low as 0.01  $\Omega$  for most models in the range.

### RHODIUM PLATING SOLUTION

An electrolyte which allows heavy deposition of rhodium of low stress, possessing a hardness of 700-800 D.P.N., is announced by ENGELHARD INDUSTRIES, LTD., Baker Platinum Division, 52, High Holborn, London, W.C.2. The electrolyte, which has been developed by the International Nickel Co. (Mond), Ltd., is similar in general chemical nature to the conventional type of sulphate solution, and containers, anodes and the general operating procedure are as for a conventional solution.

The recommended current density is 10 A/sq ft (1.075 A/sq decimetre). With an operating temperature of 50°C, the rate of deposition will be in the order of 0.0001 in (2.54 microns) in 20 min. Lower current densities are permissible, but the upper value should never exceed 20 A/sq ft (2.150 A/sq decimetre). The efficiency of the electrolyte is the same as that of a conventional sulphate solution.

As supplied, the electrolyte contains 10 grams/litre of rhodium and is prepared from Engelhard rhodium syrup No. 3820. The rhodium content should not be allowed to fall during operation to less than 9 grams/litre. Replenishment is effected by the addition of Engelhard rhodium replenishing syrup No. 3821.

### FLOORBOARD LIFTING DEVICE

The new "Imalrite" floorboard lifting-jack, designed and manufactured by G. G. GUNDRY-WHITE, 5, Elms Road, London, S.W.4, is simple to operate and it can be used to lift a 9 in floorboard in 90 sec. The only additional tool required is a carpenter's brace.

In the centre of the jack, made from a specially selected hardwood, are four screws held in position by retaining springs. The jack is placed over the floorboard to be lifted, about 3 in from the joist, and the screws are tightened down by means of a hexagonal key, held in the brace. The outside jack screws are turned alternately by the same key and brace method (approximately six turns a side) until the board is high enough to cut with a saw.

The tool, which weighs less than 2 lb, measures 11 in by 2 $\frac{3}{4}$  in by 4 $\frac{1}{2}$  in and is easily carried in a toolbag.

It is supplied complete with the hexagonal key mounted in two spring clip holders and the price is £2 17s 6d.

### WASHING MACHINE

The latest addition to the range of "Liberator" home laundry appliances to be developed by the ENGLISH ELECTRIC CO., LTD., English Electric House, Strand, London, W.C.2, is a tumble-wash washing machine. It has a washing capacity of 6-7 lb dry weight of clothes and is designed to give an unlimited choice of laundry programmes with personal control of the water temperature, length of wash, number of rinses, spin period, etc., the machine carrying out the instructions automatically.

It is a single-tub machine, rinsing, spin drying and washing actions all being carried out in the same rotating drum. No permanent plumbing is required—it is connected to the hot or cold water supply by a single hose. Castors are fitted as standard, making the appliance fully mobile, but should a fixed installation be preferred, two extra rubber feet can be fitted. A 2.75 kW immersion heater is fitted and water temperatures can be chosen to suit every type of fabric—a pilot light glows when the heater is on. The tumble-wash action stops automatically at the end of the pre-selected time, a

pump allows continuous rinsing for as long as required, and the spinning action can be set for as short a period of time as half a minute if necessary.

The door has an inset window of heat-resisting glass and the door handle is removable to prevent children opening the door during the wash. The cabinet is finished in white or cream stoved enamel and the control panel is in pale blue. The finish of the drum and container is in vitreous enamel. The "Liberator Tumble-Wash" measures 34 in high by 25 in wide and the overall depth is 25 in. It is available for the 200/220 and 230/250 voltage ranges and the price is £62 18s 10d plus £12 13s 2d tax.

### LOW-VOLTAGE SPOTLIGHT

No separate transformer is required for the new type TI.40 low-voltage spotlight fitting now being marketed by COURTNEY, POPE (ELECTRICAL), LTD., Amhurst Park Works, Tottenham, London, N.15. The transformer is part of the fitting and is housed in the base and it is not necessary for it to be plugged straight into the mains supply. In the base of the fitting a keyhole slot is provided, permitting it to be securely positioned where needed. Details of price, etc., are obtainable on application to the company.

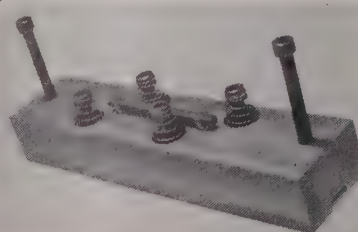


English Electric "Liberator Tumble-Wash" washing machine



Courtney, Pope type TI.40 spotlight fitting

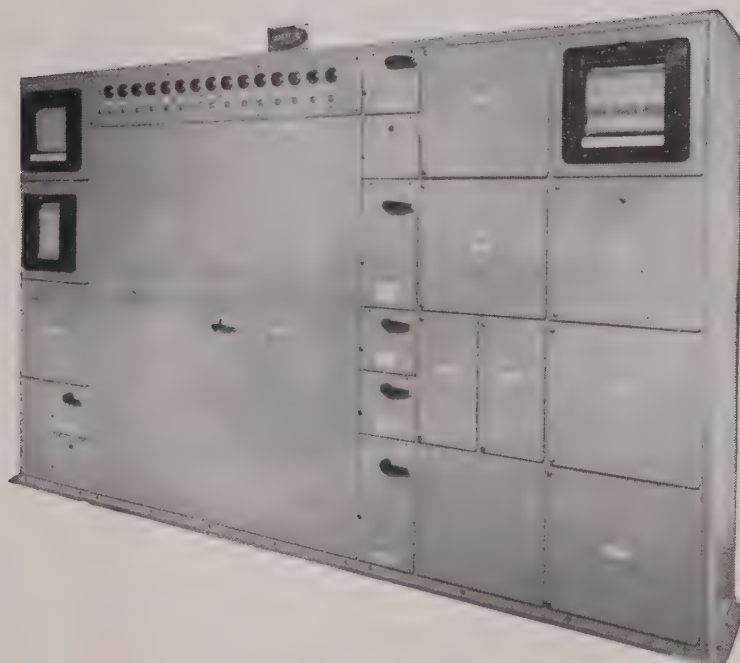
"Imalrite" floorboard jack and (right) a view of the appliance in use





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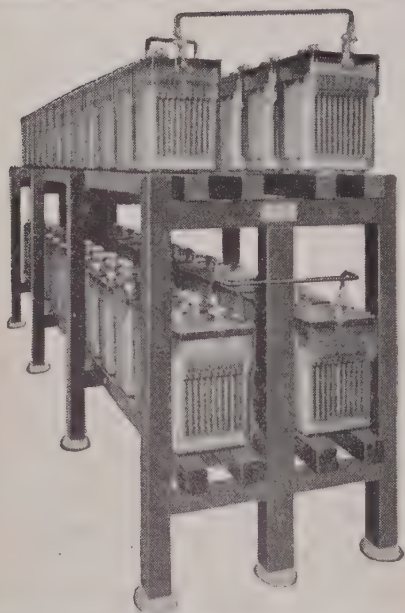


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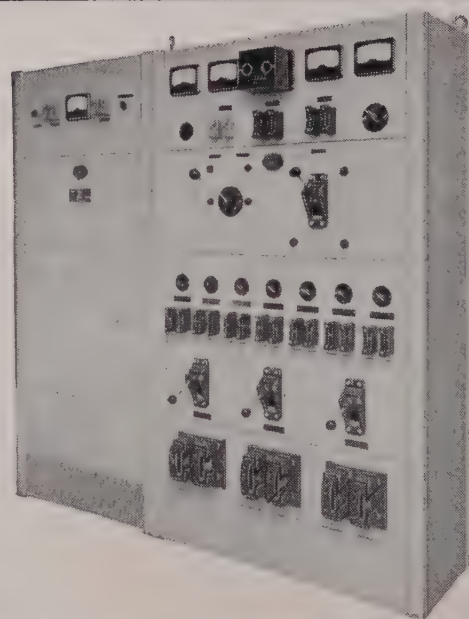
The D.P. Battery Company Ltd specialise in the design and supply of Tudor batteries, charging equipment and switchboards for industrial substations.

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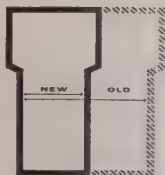


110V Tudor Battery installation consisting of 55 cells, 250 ampere-hour capacity. It is used for closing and tripping 1,000 MVA 33 kV switchgear, emergency lighting, indication and electrically operated interlocks.

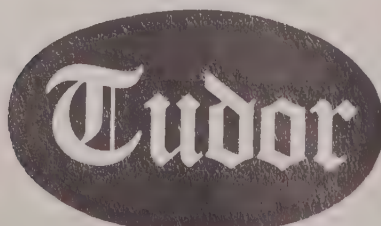
Constant potential charger and d.c. distribution board of dead-front cubicle type.  
 Photos: Courtesy John Summers & Sons Ltd.



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# Unconventional Energy Conversion Methods

## BRITISH ASSOCIATION AT NORWICH

ONE of the most interesting sessions to power engineers at the 123rd annual meeting of the British Association for the Advancement of Science, which was held at Norwich from 30th August to 6th September, was that organised by the Mathematics and Physics Section concerning unconventional methods of energy conversion. The general physical principles involved were discussed by Professor T. G. Cowling, Professor of Applied Mathematics at Leeds University. He said that the conventional energy sources depended on the indirect use of solar energy in the form of coal, oil and hydro power, or on nuclear fission, and the only additional sources available for unconventional conversion appeared to be the direct utilisation of solar energy and nuclear fusion. Solar energy was not available directly in a concentrated form. The energy at the outer limit of the earth's atmosphere was about 2 calories/sq cm/min or 1.4 kW/sq metre. A furnace had been developed, however, using concave mirrors focused at one point, capable of fusing a brick and in satellites where no material loss could be tolerated solar radiation was the most readily available form of energy. Generally, such radiation did not satisfy the availability criterion for a large scale energy source.

Nuclear fusion reactions also did not satisfy this criterion since a temperature of some  $10^8^\circ\text{K}$  was required to make the reaction adequately fast and it was difficult to attain such a temperature without vaporising the apparatus. Constraining the hot hydrogen by a magnetic field as attempted in devices like ZETA was unsuccessful due to instabilities spoiling the confinement and to temperature limitations caused by energy radiation losses.

### Electricity Generation from Nuclear Fusion

For large scale electricity generation a process was required which would probably depend on the effects inside, and at the boundaries between, electrical conductors, including ionised gases. Effects concerned with metals were generally well known and new effects seemed likely to be found only with ionised gases and semiconductors.

Professor Cowling went on to say that at the 1958 Geneva Conference on the Peaceful Uses of Atomic Energy, the Russian Artsimovitch suggested that the energy generated by a thermonuclear device could be utilised without releasing the hot plasma. In producing a pinched discharge, the plasma could be regarded as compressed adiabatically by magnetic pressures. If after compression it was heated by thermonuclear reactions its pressure was increased and it could expand and do work against the confining magnetic pressures, thereby increasing the electromagnetic energy. Practical difficulties were involved in this, however, since it was easier to expend electromagnetic energy in compressing a plasma than to recover such energy as electric currents when the plasma expanded. Further, if the work done by the plasma as it expanded was not to be balanced by

the work expended when the plasma was next compressed, heat had to be taken from it at a temperature amounting to a few million degrees K.

The magnetohydrodynamic cycle, Professor Cowling continued, utilised ionised gas at the much lower temperature of about  $2,000^\circ\text{K}$ . The gas was made to flow through a nozzle, acquiring kinetic energy as it expanded adiabatically, and pass into a transverse magnetic field which deflected ions and electrons in opposite directions. Consequently a current which could be tapped by lateral electrodes flowed in the gas perpendicular to both the magnetic field and the gas motion. The current energy was supplied from the kinetic energy of the gas which experienced a magnetic drag due to the current. The efficiency was limited by the difficulty of obtaining sufficient conductivity in the gas for it to give up its kinetic energy.

### Problem of High Temperatures

Some practical aspects were then considered by the deputy chairman of the Central Electricity Generating Board, Mr. F. H. S. Brown, particularly concerning the thermodynamic cycles in converting heat into mechanical and then electrical energy. Heat energy, he said, was normally obtained by burning a fuel—coal, oil or uranium—and temperatures about  $1,700^\circ\text{C}$  could easily be attained. No metal at present available for commercial use could withstand this continuously and heat engines used for generating the public electricity supply were limited to some  $600^\circ\text{C}$ . Some experimental installations were operating at up to  $650^\circ\text{C}$  and temperatures approaching  $800^\circ\text{C}$  were employed with small components having a limited life in, for example, aircraft gas turbines. Higher initial temperatures were possible with internal combustion engines, since the working materials were not subject to these temperatures continuously, the high temperature of combustion being destroyed by adiabatic expansion. Such engines were, however, relatively limited in rating and could not approach those sizes now demanded for electricity supply.

The regenerative Rankine cycle was most generally used, in a boiler/turbine combination, but this had a restricted peak cycle temperature and involved pumping water from the turbine condenser to the boiler, resulting in the average temperature at which heat was taken into the working fluid being appreciably lower than the peak cycle temperature. Since it was the temperature at which heat was taken in which governed the efficiency, the necessity for evaporation lowered the efficiency attainable. Plants could be designed today with a sent-out thermal efficiency of some 38 per cent, but he thought that there was not much hope in the immediate future of significant increases in this, even though the raising of steam pressures above the supercritical value, the introduction of double reheat and refinements of



the feed train, including the boiler feed pump drive, all gave finite improvements.

After mentioning the research being conducted by the C.E.G.B. into the Field cycle, which aimed at permitting high temperatures without very high pressures, he said that an advantage of the Rankine cycle was the possibility of exploiting the economics of large machines. He thought that future advances might be in the form of either better materials to withstand high temperatures continuously, the evolution of an improved method of intermittently subjecting materials to the peak cycle temperature, or the development of a method of employing continuous high temperatures without inflicting those temperatures on stressed working parts, the last two methods being the most promising.

### Other Sources

The direct production of electricity from the kinetic energy of fast moving electrically conducting gases was then described in a paper prepared by Professor M. W. Thring, Professor of Fuel Technology and Chemical Engineering at Sheffield University, and Dr. R. G. Siddall. The magnetohydrodynamic open cycle consisted of compressing and preheating combustion air, burning a rich fuel in the air and expanding the gases to a high velocity and low pressure in a nozzle. The gases passed through a magnetic field and generated d.c. between electrodes, one of which had to emit electrons into the gas. Difficulties were presented in achieving a sufficiently high conductivity in the gases by the thermal ionisation of atoms seeded into them after the temperature drop due to the adiabatic expansion. Preheating the air to 2,000°C and the use of pure oxygen for combustion were unlikely to be economic.

Thermionic generators or diodes, described in a paper by Mr. P. D. Dunn, leader of the Direction Conversion Group at A.E.R.E., Harwell, depended on an effect discovered by Edison, who observed that when a cold electrode was placed in an evacuated envelope near a heated filament, current flowed from the filament to the electrode if they were joined externally. The filament might be replaced by an electrode heated in any convenient way. Using nuclear heat sources, a diode with a uranium carbide: zirconium carbide solid solution emitter and a stainless collector had been operated at Los Alamos. Neutralisation, to prevent a space charge effect occurring between the electrodes and stopping electrons leaving the cathode, was obtained by the spontaneous ionisation of caesium vapour. Mr. Dunn thought that diodes of this type could be developed for use in future nuclear power stations. Efficiencies of 15 per cent or more might be possible, which could be added to the normal efficiency of the station.

In the final paper of this session, Professor D. A. Wright, Professor of Applied Physics at Durham University, discussed the behaviour of thermojunctions constructed from both metals and semiconductors as a source of electrical power. He said that it was possible to make cascade constructions in which thermocouples using high-temperature materials were employed in the hottest stage and the heat rejected from this stage operated a lower temperature stage and so on. With most materials at present available there were still problems to be overcome in connection with making junction elements reliable and reproducible with the correct geometry, obtaining the correct Seebeck coefficient and retaining it in operation at high tempera-

ture, preparing low-resistance contacts with the necessary stability and in some cases protecting the material from the ambient atmosphere. If these problems were solved and a cascade construction adopted, the best materials at present available operating between 1,200 and 0°C would give a junction efficiency of about 17 per cent.

### Fuel Cells

Although not included in this session, a kindred topic was dealt with by Dr. K. R. Williams, of Shell Research, Ltd., in his paper on fuel cell problems. Practical fuel cells working at 70 to 80 per cent overall thermal efficiency had, he said, been constructed. The hydrogen and oxygen cell, the simplest cell and one which was described over a century ago by Sir William Grove, was at present the most highly developed form. Essentially, hydrogen and oxygen were fed into separate electrodes and they formed water in the cell, the energy released being available as electric power. One of the engineering problems to be overcome was the removal of this water. This was achieved in one cell in which, instead of a liquid electrolyte, an ion exchange resin was used. Oxygen was provided by passing air over the appropriate electrode and the water formed merely poured off the electrode. In a dry climate, too much water was removed by air passing over the oxygen electrode and means for its replacement had to be provided.

An alternative was the high-temperature cell using fused lithium and potassium carbonates as the electrolyte. This cell operated at a temperature of about 600 or 700°C and used a mixture of air and carbon-dioxide on one electrode. The other electrode was supplied with a fuel which could be a hydrocarbon or a mixture of hydrogen and carbon-monoxide, for example. This cell required corrosion-resistant materials to withstand the electrolyte and it was difficult to make a cell which could accept the repeated temperature cycle. Starting also presented a problem, as the electrolyte did not conduct below 500°C. Carbon-dioxide had to be removed from the exhaust and recirculated to the air electrode, while water had to be injected with the hydrocarbon fuel to prevent excessive carbon formation.

An alternative low-temperature cell was that employing a liquid fuel such as methanol. At present such cells were inefficient and bulky.

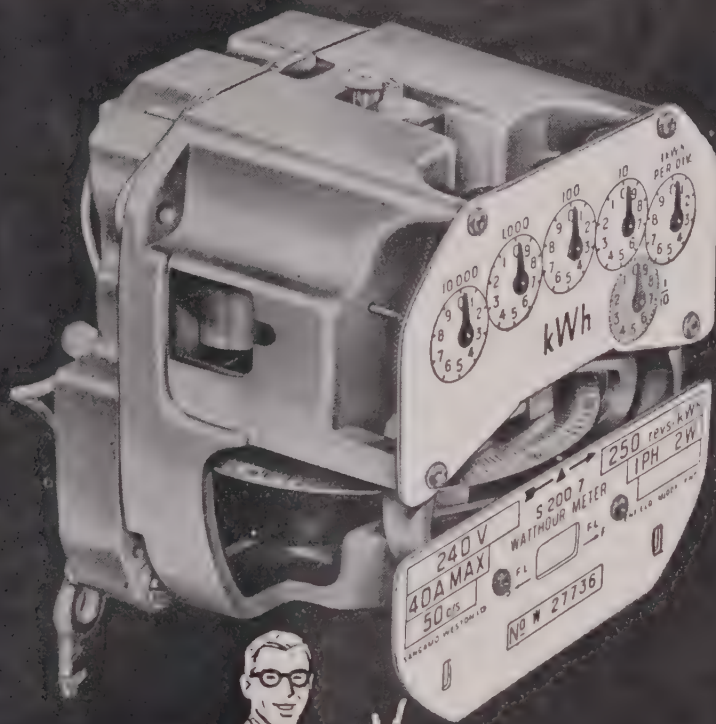
### World Communications

The president of the Engineering Section was Sir Gordon Radley, director of the English Electric Co. and Marconi's Wireless Telegraph Co. The subject of his presidential address was world communications. He said that most of the major engineering advances giving promise of improved communication had first been tried out across the North Atlantic. In describing the Commonwealth round-the-world telephone cable system, he said that one of the greatest difficulties in constructing a very long underwater section was supplying power to the repeaters. Present practice was to energise them in series by a direct current fed along the centre conductor together with the high-frequency speech currents. A total driving voltage of about 4,000 V was required for the 51 repeaters in each of the first transatlantic cables between Newfoundland and Scotland. It was arranged that the centre conductor of

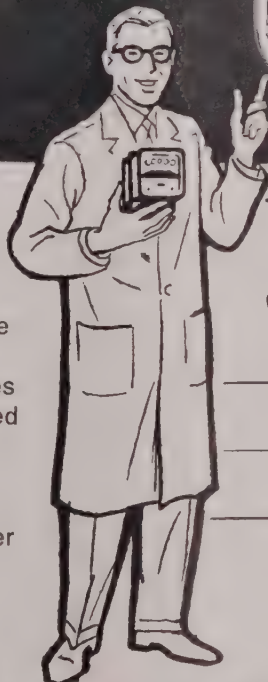
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*Ahead... right to the finish...*



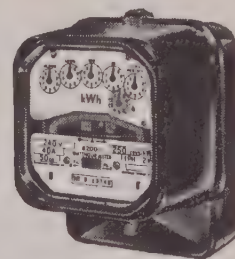
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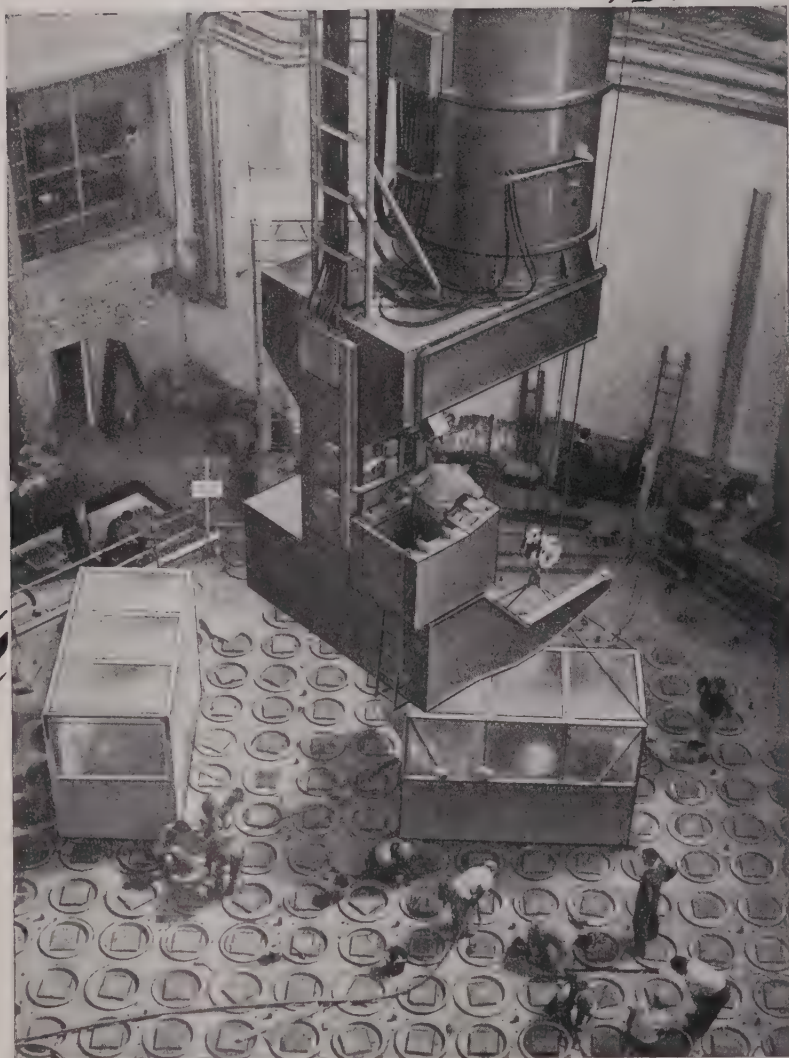


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# Control Gear



Berkeley Nuclear Power Station designed and constructed for the Central Electricity Generating Board by AEI-John Thompson Nuclear Energy Co., Ltd.

Acknowledgements also to crane makers:—  
J. H. Carruthers & Co., Ltd., Glasgow.

## at Berkeley

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Illustration shows one of the two 100 ton charge face cranes supplied by carruthers of Glasgow for Berkeley. E.M.B. supplied the control desks and the associated contactor control gear with MICROsen to give creep speed control to the A.C. slip ring motors.

# E.M.B. Co. Ltd.

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the cable and all the connected apparatus in the repeaters was at 2,000 V positive to the sea at one end and equally negative at the other. Repeaters could be adapted for 6,000 V working, and even higher voltages might be practicable inside a rigid housing of the dimensions used for the Canadian project. The use of transistors instead of valves would greatly simplify the power feeding problem, and it was possible that the first transoceanic cable with transistor amplifiers was not many years distant.

The artificial satellite which communications engineers proposed to use to expand world communications would act as a repeater station in space, having a line-of-sight path to the earth station with which it communicated. Because radio communication would no longer depend on reflection from the ionosphere it would be possible to use that part of the radio spectrum between about 1,000 and 10,000 Mc/s. This had a communication capacity several hundred times that of the h.f. band at present used. The most elementary form of communication satellite would consist of a simple reflector travelling round the earth at a height of a few thousand miles. Because of the very high power transmitters which would be needed, however, active satellites containing repeaters were more likely to be used for communication purposes.

Such satellites in circular orbits at heights between 2,000 and 6,000 miles would each complete a circuit of the earth in between three and eight hours. A number would be required so that at least one was always visible to both terminal radio stations. Satellites in circular equatorial orbits at a height of 22,300 miles would make one orbit every 24 hours and therefore appear stationary relative to a point on the earth's surface. An American proposal of the first kind would employ 50 satellites at a height of 3,000 miles to provide world-wide communication, divided into three sets in orbits making angles of 60° with each other. A variant of this, suggested in the United Kingdom, was for the use of satellites in elliptical orbits with perigees 300 miles high and apogees from 10,000 to 12,500 miles. Provided the orbits could be maintained in their relative angular positions, 12 satellites would provide complete global coverage.

With the proposal which made use of satellites with an orbital period of 24 hours, the design of the ground station equipment would be simplified, but the distance of about 45,000 miles which the signals would have to traverse in a ground-satellite-ground trip would introduce a delay of 240 msec into their transmission, or of about half a second before a reply would be received. For the transmission of telegraphy, data, television and certain other kinds of communication, this would not matter, but it might be troublesome in a telephone conversation. Solar cells to supply power for the satellite might be supported on "sails" extended after the satellite had settled in its orbit.

### Variable-Speed A.C. Motors

Another of the papers presented to the Engineering Section was concerned with stator-fed variable-speed a.c. motors. This was prepared by Mr. J. C. H. Bone, of Laurence, Scott & Electromotors, Ltd., who examined such motors operating with induction regulator control. These were available with outputs of from one to several thousand horsepower and with speed ranges up to ten to one. Speed variation of an induction motor was possible if

resistances were connected to the rotor windings through slip-rings, but the losses involved seriously reduced the machine efficiency. In the stator-fed motor the energy was returned to the supply by using a commutator (which automatically converted the variable rotor frequency to the constant supply frequency) and an induction regulator (which provided the link between the rotor voltage which varied with the motor speed and the constant supply voltage). Energy could, therefore, be exchanged between the motor rotor and the supply so that the variation in motor speed was obtained without the introduction of major losses. Energy could also be drawn from the supply and fed into the rotor, under which conditions the motor would run above synchronous speed.

### Improving Commutation

The problem of commutation in the past limited machines to low outputs per pole, and machines with large numbers of poles were restricted to low speeds. In a.c. machines, in addition to the normal "reactance" voltage due to the self-inductance of the coil opposing any change of current, there was an additional voltage between the commutator segments due to the main field which was also handled by the brushes. Commutation could be improved by increasing the resistance of the circuit during commutation, or by using high contact drop brushes, but these features were only partially effective. More successful solutions provided alternative low-impedance paths for the current in the form of an auxiliary rotor winding connected in parallel with the main rotor winding. In one design the main and auxiliary windings were separated by iron strips so that the auxiliary winding conductors were closely linked magnetically through the strips and with adjacent conductors connected to main winding turns not at the moment undergoing commutation but linked in a similar manner with other main and auxiliary turns. This "transformer" coupling between coils resulted in practically the whole of the rotor winding coils being effectively connected in parallel to the coil being commutated, acting as an effective short circuit.

After discussing brushes and brushgear, Mr. Bone dealt with induction regulators, the function of which when associated with the stator-fed motor was to provide an output voltage variable in magnitude, but substantially constant in phase. This was obtained from a double-induction regulator, consisting of two identical units coupled together electrically and mechanically. By suitable winding interconnections, the output voltages of the secondary windings of each unit could be arranged to add vectorially. There were also available many single induction regulator connections. In one, the regulator stator and rotor windings, connected in series, were fed from the secondary of a conventional transformer. Adjustment of the regulator rotor position altered the angle between stator and rotor voltages and controlled the magnitude of the output voltage which appeared between the centre tap on the transformer secondary winding and the junction between regulator stator and rotor windings. A simplification to this connection was obtained by replacing the regulator transformer by an additional winding accommodated with the motor stator windings. This provided the feed to the regulator, interchange of power between regulator and supply being obtained by transformer action between this and the normal motor stator winding.



## Financial Section

# STOCKS and SHARES

AT the annual meeting of the General Electric Company, Mr. A. L. Lindley told shareholders that finance and the unsatisfactory level of profit were two serious problems upon which the directors were engaged. Overdrafts had risen to £13 million and acceptance credits to £3½ million. Much of the former figure was however connected with the Hunterston nuclear power station and the chairman expected that after a short period various factors would contribute towards its reduction. His indication that it was not the intention to raise money by a "rights" issue came as something of a relief to the market where, however, the shares lost ground to 29s 6d. On the subject of profits, results from the opening months of the current year were said to have encouraged hopes of a recovery from what the chairman described as the exceptionally low level of 1960-61.

### Few Changes

For another week the Stock Exchange saw no sign that investors were prepared to take any fresh initiative until they knew more about the consequences of the Chancellor's policy on wages and his squeeze on credit, or about political developments abroad. Prices, however, were held fairly steady in both the gilt-edged and industrial markets. Among the few changes of note in the electrical sections, the persistent support for A. F. Bulgin shares, up to 13s 3d, continued to attract attention. A gain of over 3s in Thorn Electrical was another good feature. Dimplex were very firm at 78s 4d in front of the final dividend declaration, but W. H. Sanders were a little easier at 18s following the announcement of a 17½ per cent dividend (the same rate as before) from profits some 12 per cent lower than last year's.

### B.E.I. Results

There had been some good support for the 5s shares of British Electronic Industries up to 11s 6d in advance of the first results to be published since the Pye-Ekco merger, but they were marked back to 10s 3d after the announcement that the Pye group's profits were down by almost a million at £1.47 million, while in the case of E. K. Cole the previous year's profit of £675,000 had been turned into a loss of nearly the same figure. The

15 per cent rate of dividend indicated at the time of the merger is being paid out of Pye's surplus, but is not covered by the overall profit of £492,000 (after tax), to which is added £254,000 from exceptional items. Shareholders had been warned earlier that in the absence

of a quick and marked improvement in television sales, profits would be substantially down on the year before.

### Firth Cleveland

One of the main points of interest in Mr. C. M. Hayward's speech at the

## Price Changes in

Company or Board	Nom. Value	Middle price 11th Sept.	Week's Rise or Fall	Dividend		Yield %	1961	
				Pre-vious	Last		High-est	Low-est
Gilt-edged Stocks								
Brit. Elec. 1968/73	... 100	71		3	3	£ s d 4 4 6	75½	70½
Brit. Elec. 1974/77	... 100	66		3	3	4 11 0	70½	64½
Brit. Elec. 1976/79	... 100	68½		3½	3½	5 2 3	73½	67
Brit. Elec. 1974/79	... 100	75½		4½	4½	5 12 6	82	75
Brit. Elec. 1967/69	... 100	87		4½	4½	5 3 6	91½	86
Overseas Electric Supply								
Calcutta Elec.	... £1	21/-		7†	7½†	11 12 0	23/3	20/6
East African Power	... £1	13/9	+ 3d	8	10	14 11 0	15/-	13/-
Nigerian Elec.	... £1	17/6	- 1/-	8	10	11 8 6	19/9	15/6
Perak Hydro-Elec.	... £1	21/3		10	10	9 8 3	23/6	17/6
Electrical Shares								
Aberdare Holdings	... 5/-	15/-		17½	17½	5 16 9	17/-	14/3
Aerialite	... 1/-	4/9		54	54	11 7 0	8/-	4/6
Allen, W. H.	... £1	30/-		14	10*	6 13 3	42/6	30/-
Allied Insulators	... 5/-	8/-		20	10*	6 5 0	10/-	8/-
Alwyn Holdings	... 5/-	20/6	- 1/-	12½	15½*	3 13 3	22/3	16/6
Anglo-Portuguese Tel.	... £1	20/-		9	9	9 0 0	25/-	18/9
Arcoelectric	... 1/-	4/9		15	15	3 3 3	6/-	3/9
Aron Meters	... 5/-	20/-		15	15	3 15 0	20/-	17/-
Assoc. Elec. Ind. Ord.	... £1	37/9	- 3d	15	15	7 19 0	48/6	35/-
Automatic Tel. & El.	... 5/-	15/9	- 6d	17	17	—	20/6	12/9
Babcock & Wilcox	... £1	26/3	- 6d	9	9	6 17 3	36/6	25/6
Bakelite	... 10/-	46/3	+ 1/3	17½	17½*	3 15 9	60/-	42/-
Baldwin, H. J.	... 2/-	1/3		10	Nil	—	1/9	1/3
Berry's Electric	... 5/-	53/6	- 1/3	30	33½*	3 2 3	53/6	37/-
Bowthorpe Holdings	... 2/-	7/9		18½	22	5 13 6	10/3	7/9
Brit. Elec. Resistance	... 2/-	7/-		17½	17½*‡	5 0 0	8/9	6/6
Brit. Elec. Traction:								
Def. Ord. "A"	... 5/-	51/-	+ 2/6	40	50	4 18 0	57/6	41/9
British Electronic Ind.	... 5/-	10/3	- 9d	—	15	7 6 3	15/3	8/9
B.I. Callender's	... £1	59/3	+ 1/6	13½	13½	4 11 3	62/3	49/6
B.I. Callender's 6% Pref.	... £1	16/6		6	6	7 5 6	18/3	16/6
British Thermostat	... 5/-	30/-		20	27½	4 11 9	40/-	28/-
Brook Motors	... 10/-	53/-		25	25*	4 14 3	55/-	47/-
Bulgin, A. F.	... 1/-	13/3	+ 1/-	55	40*	3 0 6	13/3	7/9
Bulpitts	... 5/-	17/9		15	16½	4 11 6	27/6	16/9
Burco Dean	... 5/-	6/6	+ 3d	18	15	11 10 9	11/9	6/3
Cable & Wireless	... 5/-	17/3	- 6d	10	10*‡	2 18 0	19/9	12/6
Cambridge Instruments	... 5/-	32/-		12½†	22	3 8 9	38/6	30/-
Chloride El. Storage "A"	... £1	83/-	+ 6d	17½	20	4 16 6	91/-	72/-
Clarke Chapman	... £1	38/-	+ 6d	13½	13½	7 4 9	54/-	37/6
Clarke, T.	... 2/-	4/-		16	16	5 6 9*	5/3	3/6
Combined Elec. Mfrs.	... 4/-	7/-	+ 3d	—	12½	7 2 9	10/-	6/9
Contractor Switchgear	... 5/-	13/3	- 6d	14	14	5 5 9	16/-	12/9
Cossor, A. C.	... 5/-	7/3		Nil	Nil	—	8/-	5/6
Crabtree	... 10/-	24/-	- 6d	20	12½*	5 4 3	33/9	24/-
Crompton Parkinson	... 5/-	12/3	+ 3d	14	12½*	5 2 0	14/6	11/3
De La Rue	... 10/-	53/9	+ 2/9	22½	22½*	4 3 9	70/-	51/-
Decca "A"	... 10/-	61/3	+ 9d	20	23½	3 15 9	70/-	52/3
Desoutter	... 5/-	55/-		30	35	3 3 9	68/9	49/-
Dewhurst	... 2/-	4/6		20	20	4 9 0*	6/6	3/9
Dictograph Tel.	... 2/-	10/3	+ 3d	20	20*	3 18 0	13/-	8/6
Dimplex	... 5/-	78/9	+ 2/6	—	30	1 11 9*	83/9	47/-
Dubilier Condenser	... 1/-	2/-		30	15*	7 10 0	3/-	2/-
Duport	... 5/-	11/-		17½	20	6 1 3*	17/-	11/-
E.M.I.	... 10/-	37/-	+ 3d	20	17½*	4 14 6	51/3	36/9
Eleco	... 2/-	8/3	+ 3d	20	20*‡	4 17 0	10/6	4/3
Electrical Apparatus	... 5/-	18/-		14½	20	5 11 0	21/-	17/-
Electrical Components	... 5/-	8/3	+ 6d	11½	12½	7 11 6	9/9	7/9
Elec. Construction	... £1	22/6		9	5	4 9 0	39/-	20/3
Elliott-Automation	... 5/-	34/6	- 6d	9.3	13	1 17 9	37/6	25/6
Enfield Rolling Mills	... £1	39/6		15	15	7 12 0	51/6	39/6

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.

\* After scrip issue.

† Free of income tax.

‡ Dividend indicated.



annual meeting of Firth Cleveland was his analysis of the contributions made by the various components to the earnings of this many-sided group. From this it appeared that more than half the 1960 earnings came from the retail divisions, concerned largely with

radio, television and domestic appliances; and nearly 20 per cent from engineering, electronics and instruments, which now include the Solartron Electronic Group. The chairman stressed the advantages of well-balanced diversification and his review

gave a generally favourable impression about progress.

### Efco Progress

Earnings of Efco, whose annual meeting is to be held next Tuesday, improved by about 11 per cent in 1960-61 despite the disturbing effects of extensive changes to improve and enlarge the production facilities, and in his statement with the report the chairman regarded the outlook as promising. The intake of orders, he said, had been well maintained in the opening months of this financial year, and satisfactory progress was being made by the three companies formed recently in association with other firms. Of these, Birlec-Efco, in which A.E.I. are partners, was said to have on hand orders to the value of several million pounds. The austerity of the directors' distribution policy has been relaxed a little in the past three years, but the 11½ per cent rate of dividend is still well covered by earnings.

### James Scott

The 5s shares of James Scott (Electrical Holdings) have maintained their value exceptionally well during the market disturbances of recent months. At 30s they stand only 2s below the year's best price, and offer a yield of just over 4½ per cent on a dividend of 27½ per cent, covered 2½ times by the latest figures. Profits have risen steadily since the shares were marketed six years ago, and shareholders have enjoyed annual increases in the dividend during this period. They were told last month of record amounts of work in hand and orders received. Demand for the company's services was said to be rising and the chairman looked forward to increased participation by the company in the further expansion of the uses of electricity.

### Philips Lamps

Although Philips Lamps shares at £10 stand some £3 below their recent best, the yield is still little more than 1½ per cent and is typical of the exiguous returns offered to the investor who is impressed by the growth possibilities of the leading Continental equities. The popularity of Philips shares rests on a remarkably long and consistent record of expansion, and last month's setback in the price of the shares was occasioned only by the evidence in the half-yearly report that sales were improving at a rate slower than had been anticipated. This suggested also, however, that neither television troubles nor shrinking profit margins were peculiar to this country, and that there might be some material reduction in the company's 1961 results for the first time in many years.

## Electrical Investments

Company or Board	Nom. Value	Middle price 11th Sept.	Week's Rise or Fall	Dividend		Yield %	1961	
				Pre-vious	Last		High-est	Low-est
Electrical Shares—continued						£ s d		
English Electric ...	£1	30/-	-6d	10	10	6 13 3	40/9	29/9
English Electric 3½% Pref. ...	£1	10/-		3½	3½	7 10 0	11/9	10/-
Ericsson ...	5/-	27/-	-3d	13½	13½	—	32/-	22/3
Ever Ready ...	5/-	38/-	+6d	20	22½	2 19 3	40/-	31/6
Falk Stadelmann ...	£1	22/6		10	7½	6 13 3	26/-	21/9
G.E.C. ...	£1	29/6	-2/-	10	10	6 15 6	39/6	28/9
G.E.C. 6½% Pref. ...	£1	16/6		6½	6½	7 17 6	19/3	16/6
General Cables ...	5/-	5/-	-3d	15	Nil	—	6/3	5/9
G.H.P. Group ...	£1	21/-		6	7½	6 13 3	24/6	17/-
Goblin (B.V.C.) ...	5/-	4/6		12½	10	11 2 0	8/6	4/3
Hackbridge Holdings ...	5/-	6/-		20	10*	8 6 9	6/9	5/-
Harland Engineering ...	5/-	13/3		16	16	6 0 9	19/-	13/3
Head Wrightson ...	5/-	23/6		14	16	3 8 0	30/-	22/-
Heatrae ...	2/-	13/9		12½	25	3 12 9	19/-	12/6
Holophane ...	5/-	16/-		26	30	9 7 6	20/6	16/-
Hoover ...	5/-	42/6	+2/6	90	45*	5 6 0	55/6	37/6
Hunt, A. H. ...	4/-	18/9		20	20	4 5 3	25/9	18/-
Intl. Combustion ...	5/-	24/-	-1/-	30	30	6 5 0	33/9	24/-
Intl. Computers & T. ...	£1	93/9		10	11½	2 8 0	107/-	59/-
Johnson & Phillips ...	£1	20/9		Nil	5	4 16 6	24/-	17/6
Kenwood Mfg. ...	1/-	4/-		—	—	—	6/-	4/-
Laurence Scott ...	5/-	14/3		15	15	5 5 3	18/9	14/3
Lister, R. A. ...	£1	51/-		14	14	5 9 9	56/9	45/6
Lucas, J. ...	£1	53/9	+1/3	12½	13½	5 2 3	71/6	52/6
Marryat & Scott ...	2/-	16/9		27½	32½	3 17 6	18/6	13/9
Mather & Platt ...	£1	38/-	+6d	11	11	5 15 9	51/6	37/6
Metal Industries ...	£1	57/-	+1/-	15	15	5 5 3	66/6	50/-
Midland Elec. Mfg. ...	£1	58/9		12	12	4 1 9	67/6	58/6
Murex ...	£1	41/3		20	13*	6 6 3	51/6	39/3
Newman Ind. ...	2/-	7/-		12½	15	4 5 9	7/6	5/-
Oldham & Son ...	1/-	2/9		17½	17½*	6 7 3	3/-	2/3
Parsons, C. A. ...	£1	51/3		9½	12½	4 17 6	72/6	46/9
Philips' Lamps ...	£1.10	200/-		16	16*	1 12 0	£13½	£9½
Plessey ...	10/-	47/6	-1/3	17	15*½	4 4 3*	60/-	46/6
Pullin Group ...	2/-	11/6		25	25	4 7 0	15/-	11/3
Pyrotenax ...	5/-	55/-		40	45	4 1 9	65/-	46/6
Radiation ...	£1	24/3	+9d	12	10	8 5 0	37/6	23/6
Reliance-Clifton ...	5/-	28/6		15	20	3 10 3	32/6	22/6
Reyrolle ...	£1	41/9	+6d	17½	9½*	4 13 6	51/6	36/6
Richardsons Westgarth ...	10/-	4/3	-3d	8½	Nil	—	8/3	4/3
Sangamo Weston ...	10/-	18/9		12½	13½	5 6 9*	25/9	18/9
Scott, James ...	5/-	30/-		25	27½	4 11 9	32/-	25/6
Simon Engineering ...	5/-	37/6	+1/3	—	27½	3 13 3	43/9	28/-
Smith (England), S. ...	4/-	14/9		17½	20	5 8 6	23/9	14/6
Southern Areas ...	£1	17/6	+1/-	5	6	6 17 3	23/-	14/6
Strand Elec. ...	5/-	18/-		14.6	20	5 11 0	20/-	12/3
Sturtevant ...	5/-	10/9	-3d	15½	13½	9 19 0	18/6	10/9
Sun Elec. ...	5/-	15/6		15	18½	5 19 0	17/6	15/6
T.C.C. ...	10/-	41/3		35	22½*	5 9 0	43/9	40/-
Telephone Rentals ...	5/-	24/9		15	15½*	3 0 6	29/6	18/6
Thompson (John) ...	5/-	13/9		20	5	—	16/9	13/9
Thorn Elec. ...	5/-	54/6	+3/3	25	25	2 5 9	63/-	44/6
Thornycroft ...	4/-	5/6		6	6	—	7/-	5/6
Tube Investments...	£1	62/6	+6d	—	14	4 9 6	85/-	62/-
Ultra Electric ...	5/-	25/-		20	25	—	31/3	12/6
Walsall Conduits ...	4/-	11/-	+3d	15	15	5 9 0	15/-	10/9
Ward & Goldstone ...	5/-	28/9		35	17½*	3 0 9	36/6	25/6
Watford ...	2/-	6/9	-3d	25	20*	5 18 6	10/9	6/9
Westinghouse ...	£1	32/-		11	11	6 17 6	45/-	32/-
West, Allen ...	5/-	11/-		12½	13½	6 2 6	14/6	10/3
Wilkins & Mitchell ...	5/-	8/9		21	12	6 17 3	15/3	8/9
Wolf Electric ...	5/-	13/6		12½	13½	5 1 9	17/6	13/6



## REPORTS and DIVIDENDS

**General Electric's Recovery.**—Mr. Arnold Lindley, chairman, said at the annual meeting of the General Electric Co., Ltd., last week that trading results for the first four months indicated that there were good grounds for expecting a recovery in profits from last year's "exceptionally low level." There were signs, he said, of improved trading at home and abroad and the overall position showed an upward trend. Most of the company's factories were well supplied with work.

The two serious problems that engaged the board were the unsatisfactory level of profit and finance, Mr. Lindley said. The net overdraft, which at the end of March was £11½ million, was now £13 million. Acceptance credits were up from £2 million to £3½ million. The principal reason for the size of the overdraft was the Hunterston nuclear power station contract where work had absorbed £8½ million more than payments received—and this did not include any financing by associates.

The overdraft would remain at this level for a short period, Mr. Lindley said, after which it would be reduced as a result of realisations, seasonal factors and more satisfactory cash flow. Nuclear work would in future be handled by the United Power Co., Ltd.

The value of large contracts being executed on the heavy engineering side at present was very much higher than five years ago and a larger volume of work in progress was consequently involved.

The increased bank rate was a penal measure. Mr. Lindley hoped that the incidence of dear money would not persist too long as it was a serious handicap to export business.

If Britain became a member of the Common Market, the G.E.C. would, Mr. Lindley said, manufacture some goods in Common Market countries and establish a system of licensing and cross-licensing in addition to direct exports. A financial interest had been taken in a small firm manufacturing lamps in France and agencies for the sale of a number of G.E.C. products had been arranged.

**A. J. Flatley's Creditors.**—The principal creditors of A. J. Flatley, Ltd., proposed a moratorium rather than a liquidation at last week's meeting. Trade creditors are to receive 21s in the £—which includes interest—if they agree to accept payments spread over until 1st October, 1962.

The conditions provide that until

payments have been completed, the business shall be conducted by the directors in consultation with Peat Marwick Mitchell & Co., assisted by a committee of creditors. In particular the directors shall not place any orders or enter into any contracts or make any payments in excess of £100 without prior consultation with Peat Marwick and goods supplied to and work done for the company during the moratorium period are to be paid for in cash. Neither the committee of creditors nor Peat Marwick will bear any financial responsibility for the conduct of the business during the moratorium.

Peat Marwick state that it is evident from an examination of the balance sheet that the company's present difficulties are not due to trading losses but to expenditure on capital assets and stocks for which adequate finance was not available. In the year ended 30th June, 1960, stocks rose from £50,750 to £357,820 and at 30th June, 1961, they amounted to £584,048.

Peat Marwick state: "We are informed that this position has been mainly brought about by over-purchasing of raw materials which, in the off-season for dryers, were used to produce finished goods. The management estimate that all the finished goods in stock will be sold before the end of this year with the exception of the standard washers and wringers, in respect of which approximately £60,000 may be immobilised beyond the year-end.

"The production of the standard washer has now ceased and the manufacturing capacity is being concentrated mainly on dryers.

"We have formed the opinion that if the company can continue to trade at a profit its present financial difficulties can be resolved provided that: (a) No further capital expenditure is undertaken; (b) Production and stock levels are limited to quantities sufficient to meet demand estimated on a realistic basis; (c) Credit control and follow-up of outstanding accounts is rigorously applied; (d) The creditors agree to a moratorium on conditions to be agreed.

"In the meantime the possibility of securing additional permanent finance, which is essential if the business is to continue at the present level of trading, should be actively pursued."

**Telephone Manufacturing Co., Ltd.**, have a full order book and Mr. C. H. Jackson, chairman, expects that the current year's results will show further

improvement. Success in broadening the basis of the company's operations will always depend in large measure on the home market, which is essentially the Post Office. Business overseas can only be obtained at reduced margins, particularly in the case of subscribers' equipment. Nevertheless, 23 per cent of total turnover for the 15 months under review was for direct export.

**British Electronic Industries, Ltd.**, are paying 15 per cent for the year ended 31st March last. Group profits amounted to £726,781 and the net profit to £594,939. One of the two constituent companies, **E. K. Cole, Ltd.**, suffered a loss, and the ordinary dividend, it is stated, is to be paid out of the profits of **Pye, Ltd.** These fell from £2,423,884 to £1,473,902 and the net profit was £1,032,405 against £1,464,274. **E. K. Cole, Ltd.**, made a total loss of £356,181 compared with a profit of £410,428.

**Murex, Ltd.**—Group sales in the past year increased by 9 per cent to £11.75 million although competition was keen and selling prices lower, says Mr. H. J. Penn, chairman, in his annual report. Demand for the group's products in the opening months of the current year have been "satisfactory" and the long-term outlook is "encouraging." Indications are that the demand for the company's rarer metal products will expand and there is a promising future for automatic electric arc welding.

**W. H. Sanders (Electronics), Ltd.**, are paying a dividend of 17½ per cent for the year to June last, against a forecast of 15 per cent. Group trading profit is £93,536 (£107,168).

**Clydesdale Supply Co., Ltd.**—An offer by a consortium of eight finance houses to take over the claims of unsecured creditors was accepted at a meeting of creditors last week. The consortium, all substantial creditors, offered 20s in the pound, on or before 31st October, to unsecured creditors with claims of £25 or less, and 6s in the pound for unsecured creditors with claims for larger amounts. The consortium also hope to make an issue of shares to the unsecured creditors.

**A. Reyrolle & Co., Ltd.**—Interim dividend 3¼ per cent (same).

**Telegraph Condenser Co., Ltd.**—Interim dividend 5 per cent (same).

### New Companies

**Consolidated Electrodynamics Corporation (U.K.), Ltd.**—Registered 30th August. Capital £10,000. Regd. office: 11, Old Jewry, E.C.2.

**Postings Bros., Ltd.**—Registered 23rd August. Capital £10,000. To acquire the business of electrical engineers and contractors



carried on by C. A. Postings and W. J. Postings at 148, Horseley Fields and at Broad Street, Wolverhampton, as C. A. & W. J. Postings, etc. Directors: C. A. Postings and W. J. Postings. Secretary: Christine A. Postings. Regd. office: Union Street, Horseley Field, Wolverhampton.

**A. C. Hayes, Ltd.**—Registered 24th August. Capital £1,000. Electrical engineers, manufacturers of and dealers in dynamos, motors, etc. Directors: A. C. Hayes and S. H. McCormick. Secretary: Evelyn S. Hayes. Regd. office: 117, Hagley Road, Birmingham, 16.

**Cooper & Muir, Ltd.**—Registered 24th August. Capital £100. Manufacturers, marketers and designers of electrically operated heating panels and other forms of space heating, etc. Directors: R. Cooper and Marjorie Muir. Secretary: R. M. S. George. Regd. office: 164, Bishopsgate, E.C.2.

**T.R. (Electrics), Ltd.**—Registered 24th August. Capital £500. Manufacturers of and dealers in, hirers out and repairers of electrical and electronic goods of all kinds, etc. Directors: Mary Heaton and T. Rogers. Secretary: Margaret Grundy. Regd. office: 10, Park Square, Leeds, 1.

**W. R. Hammond & Son, Ltd.**—Registered 24th August. Capital £1,000. Electrical, radio, television, mechanical and general engineers, etc. Directors: W. R. Hammond, Doris E. Hammond (secretary) and D. Hammond. Regd. office: Mill Street, Eynsham, Oxford.

**W. Wall (Electrical), Ltd.**—Registered 25th August. Capital £2,000. Electrical engineers, etc. W. Wall, junr., is the first director. Regd. office: Walnut Street, Halifax.

**Direct Electrical Contractors, Ltd.**—Registered 15th August. Capital £100. Directors: W. C. Howell and Margaret A. Howell. Secretary: Hilda M. Tomlinson. Regd. office: 500, Staines Road, Twickenham, Middx.

**F. L. Brooks & Co., Ltd.**—Registered 15th August. Capital £2,000. Manufacturers of and dealers in artificial lighting apparatus, electrical and gas plant, etc. Directors: W. P. Harding and Gladys L. Harding, both of "Breckland," Ashmans Road, Beccles, Suffolk.

**Colourent, Ltd.**—Registered 11th July. Capital £100. Electrical and radio engineers, etc. Directors: D. H. Crisp and O. H. Tramontini. Secretary: T. A. Spittle. Regd. office: 26, Christchurch Road, Bournemouth.

**Power Motor Rewind & Repair Co., Ltd.**—Registered 11th July. Capital £8,000. Directors: I. B. Bull and D. W. Stow. Secretary: D. L. Mills. Regd. office: Spurgeon Street, Colchester, Essex.

**Lavall Electrical Services, Ltd.**—Registered 11th July. Capital £1,000. Manufacturers of, wholesale and retail dealers in, servicing agents and hirers and letters on hire of all kinds of radio, television and electrical apparatus, etc. Directors: M. H. Lay (secretary) and R. W. Vail. Regd. office: Prudential Buildings, St. Andrew's Street, Cambridge.

**I.E.C. (Electronics), Ltd.**—Registered 13th July. Capital £5,000. Directors: R. A. Saville-Sneath (chairman) and Monica E. Saville-Sneath. Solicitors: Bulcraig & Davis, Amberley House, Norfolk Street, W.C.2.

**Electrical Installation (Cambridge), Ltd.**—Registered 17th July. Capital £1,000. Directors: B. S. Baldry (secretary) and R. H. Ransome. Regd. office: 52, George Street, Cambridge.

**Northern Electrical Service Co. (London), Ltd.**—Registered 17th July. Capital £2,000. Subscribers: J. D. Martin and M. J. Culleton. Solicitors: Wm. White & Co., W.2.

**Bacel, Ltd.**—Registered 18th July. Capital £100. Electrical engineers, etc. Directors: G. Nadin, Vera Nadin (secretary), A. Watts and Margaret Watts. Regd. office: 3, Handsworth Crescent, Sheffield, 9.

**Thomas, Hargreaves & Co., Ltd.**—Registered 18th July. Capital £100. Manufacturers of and dealers in electrical goods of all kinds, etc. Directors: R. C. Thomas and R. Hargreaves. Secretary: D. Jacobs. Regd. office: 89/91, Newman Street, W.1.

**Venour Electrical Co., Ltd.**—Registered 10th August. Capital £1,000. To acquire

the business of electrical engineers carried on by S. S. Venour and R. S. Venour at 29, Cranmore Road, Castle Bromwich, etc. Directors: S. S. Venour, R. S. Venour, F. Smith and R. A. Ainsworth. Secretary: Doris M. Cann. Regd. office: Devonshire House, Great Charles Street, Birmingham, 3.

**L. N. Collett, Ltd.**—Registered 10th August. Capital £5,000. Manufacturers of and dealers in electrical goods, etc. Directors: Lucy N. Collett and C. A. Collett (secretary). Regd. office: Lombard House, Great Charles Street, Birmingham, 3.

**Specialised Electrical Services, Ltd.**—Registered 11th August. Capital £100. Directors: R. J. B. Wilson (secretary) and Mrs. Elizabeth A. Wilson. Regd. office: Somerset House, Blagrove Street, Reading.

**Palmer's Electrical, Ltd.**—Registered 14th August. Capital £1,000. Electrical engineers, etc. Directors: K. H. W. Palmer, E. A. Tooke and Margaret Amies (secretary). Regd. office: 28, Douro Street, Norwich.

**T. Patterson, Ltd.**—Registered 27th July. Capital £1,000. Electrical engineers and contractors, etc. Regd. office: 73, Cross Green Lane, Leeds, 9.

**West Herts Electrical Services, Ltd.**—Registered 27th July. Capital £500. Directors: Mrs. Barbara J. Coleman and N. T. Coleman. Secretary: Mrs. R. Davis. Regd. office: 22, Dunstable Road, Luton, Beds.

**Princedale Electrical Co., Ltd.**—Registered 28th July. Capital £1,000. Electrical engineers, etc. Directors: G. R. Howard and A. J. Howard. Secretary: Pamela E. Smith. Regd. office: 46, Old Bond Street, W.1.

**Electro Installations (Scotland), Ltd.**—Registered 28th July. Capital £100. Electrical installation and maintenance contractors, etc. J. A. Atkins is the first director. Secretary: Joan M. Atkins. Regd. office: 54, Old Broad Street, E.C.2.

**Electric Motor Development (Halstead), Ltd.**—Registered 3rd August. Capital £500. Directors: J. W. Horwood and Mrs. Ivy M. Horwood (secretary). Regd. office: Factory Lane West, Halstead, Essex.

**George Dunn, Ltd.**—Registered 2nd August. Capital £1,000. Electrical engineers, etc. Directors: G. Dunn and Mary M. Dunn. Regd. office: 10, Longport Street, Canterbury.

**Delta Electrical Co. (Enfield), Ltd.**—Registered 21st August. Capital £1,000. To acquire the business of Joseph G. Darville carried on at 153e, Baker Street, Enfield, as the Delta Electrical Co., etc. Directors: J. G. Darville (secretary) and Mrs. Florence Darville. Regd. office: 86, Halifax Road, Enfield, Middx.

**James Duff & Son (Electrical), Ltd.**—Registered 20th July. Capital £100. Manufacturers of and dealers in vacuum cleaners, etc. Directors: C. J. Duff (secretary) and D. J. Duff. Regd. office: Lloyds Bank Chambers, High Street, Baldoak.

**W. T. Bingham (Electrical Contractors), Ltd.**—Registered 31st July. Capital £5,000. Directors: W. T. Bingham and Mrs. Hilda Bingham (secretary). Regd. office: 847, Chesterfield Road, Sheffield, 8.

**Bruce Williams & Sons, Ltd.**—Registered 1st August. Capital £100. Electrical engineers, etc. Directors: B. Williams and Barbara Williams (secretary). Regd. office: 11, Peter Street, Manchester, 2.

**Cook & Ellington, Ltd.**—Registered 1st August. Capital £1,000. Electrical engineers and general electrical installation contractors, etc. Directors: H. Cook (secretary) and J. N. Ellington. Regd. office: Aislaby House, Thorpe Thewles, Co. Durham.

**A. & R. Marsh (Electrical), Ltd.**—Registered 31st July. Capital £100. Electrical and building contractors, etc. Directors: A. W. Marsh and Ruth M. B. Marsh (secretary). Regd. office: The Grange Office, Grange View Road, Whetstone, N.20.

**Eric Frairs of Whitehall, Ltd.**—Registered 9th August. Capital £100. Vendors and manufacturers of electrical appliances, etc. E. Frairs is the first director. Secretary: M. Boltsa. Regd. office: 12, Whitehall, S.W.1.

## Liquidations

*Winding-up proceedings or liquidations are often undertaken for the purpose of reconstruction, the transfer of a business, or other reasons. The appearance of a company's name under this heading therefore does not necessarily indicate insolvency.*

**Audiovision (Electrical), Ltd.**, dealers in electrical goods, 27-28, Finsbury Square, London, E.C.2.—Winding up voluntarily. Liquidator, Mr. S. J. Baker, of the above address, appointed by the company on 22nd August. Particulars of claims to the liquidator by 30th September.

**Nortic Electrical, Ltd.**, dealers in domestic appliances, Bucklersbury House, Bucklersbury, London, E.C.4.—Winding up voluntarily. Liquidator, Mr. G. A. Weiss, 19, Eastcheap, London, E.C.3, appointed by members and creditors on 28th August. Particulars of claims to the liquidator by 30th November.

**Neptric, Ltd.**, Bucklersbury House, Bucklersbury, London, E.C.4.—Liquidator, Mr. G. A. Weiss, 19, Eastcheap, London, E.C.3, appointed by members and creditors on 28th August. Particulars of claims to the liquidator by 30th November.

**Michael Neidle, Ltd.**, electrical engineers, 46, Blandford Street, London, W.1.—Winding up voluntarily. Liquidator, Mr. C. V. Shaw, of the above address, appointed by members and creditors on 25th August.

**W.E.K. (Electrical), Ltd.**, 124, Chancery Lane, London, W.C.2, manufacturers of and dealers in electrical and radio instruments.—Liquidator, Mr. T. J. M. Macleod, 4, Bucklersbury, Cheapside, E.C.4, released 21st June.

**Telefix, Ltd.**, dealers in radio, television and electrical goods, 76, Shepherds Bush Road, London, W.6.—Liquidator, Mr. B. Phillips, 76, New Cavendish Street, London, W.1, appointed 25th August with a committee of inspection.

**Philip Greene, Ltd.**, electrical contractors, 242, Old Kent Road, London, S.E.1.—Last day for receiving proofs for dividend 22nd September. Liquidator, Mr. H. M. Arthur, 6, Cavendish Court, 11-15, Wigmore Street, Cavendish Square, London, W.1.

**W. J. Thompson (Electrical), Ltd.**, electrical engineers, 28, Mackenzie Street, Slough, Bucks.—Creditors' voluntary winding-up. Liquidator, Mr. T. H. Griffith, of the above address appointed by the company and creditors on 31st August. Particulars of claims to the liquidator by 31st October.

## Winding-Up Petition

**Allray Electrical Engineering Co., Ltd.**—A petition for the winding-up of the company has been presented to the County Court, Westgate Street, Cardiff, and is to be heard on 19th October. Anyone intending to appear should notify Needham & James, 380, Stratford Road, Sparkhill, Birmingham, 11, by 18th October.

## Bankruptcies

**F. Whittall**, 25, Collingwood Street, Barrow-in-Furness, electrical dealer.—Receiving order made 30th August on a creditor's petition.

**S. & E. Electrical**, electrical dealers, lately carrying on business at 23, Greyfriars Street, Northampton.—Receiving order made 30th August on a creditor's petition.

**N. W. Doidge and J. C. Stephenson**, formerly carrying on business in partnership as Doidge & Stephenson at 16, Coldwell Street, Felling, Durham, electrical contractors.—Supplemental dividend of 2s 11½d in the £ payable at Clarendon House, Clayton Street West, Newcastle-upon-Tyne, 1.

**L. Filby and G. D. Brown**, lately carrying on business in co-partnership under the name of Filby & Brown at 44, Park Street, Brighouse, Yorks., radio, television and electrical engineers.—Last day for receiving proofs for dividend 23rd September. Trustee, Mr. J. L. Williams, 20, North Parade, Bradford.



## NEW PATENTS

## Electrical Specifications Recently Published

*The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2*

## 1956

30193. Associated Electrical Industries, Ltd.—Securing devices for filamentary material. 26th September, 1957. (876841.)  
30784. Machines for continuously spooling filamentary material. 7th October, 1957. (876842.)

36758. A. H. Hunt (Capacitors), Ltd.—Electrical capacitors. 26th February, 1958. (876477.)

38164. Electric & Musical Industries, Ltd.—Colour television receivers. 11th December, 1957. (876666.)

## 1957

1056. British Insulated Callender's Cables, Ltd.—High voltage cable joints and terminations. 10th January, 1958. (876507.)

2373. National Research Development Corporation.—Linear polyphase induction machines. 15th January, 1958. (876795.)

8052. Automatic Telephone & Electric Co., Ltd.—Arrangements for metering telephone calls. 12th February, 1958. (876538.)

21927. General Telephone Laboratories, Inc.—Translator for a telephone system. 10th July, 1957. (876983.)

30576. Texas Instruments, Inc.—Electrical switch structures. 30th September, 1957. (876479.)

31551. Igranic Electric Co., Ltd.—Electric amplifier systems. 9th October, 1957. (876855.)

31769. Petrix-Union G.m.b.H.—Galvanic cell with plate electrodes. 11th October, 1957. (876572.)

33584. Brush Electrical Engineering Co., Ltd.—Control of electrical machines. 11th December, 1958. (876935.)

34644. Mabuchi, T.—Miniature electric motor. 6th November, 1957. (876574.)

35134. Amphénol-Borg Electronics Corporation.—Multi-turn potentiometers. 11th November, 1957. (876880.)

36485. Philips Electrical Industries, Ltd.—Unidirectionally self-starting synchronous motors. 22nd November, 1957. (876576.)

38043. Stabilimenti Elettromeccanici Riuniti Ansaldo San Giorgio S.p.A.—Rheostats. 6th December, 1957. (876801.)

38987. Nippon Telegraph & Telephone Public Corporation.—Manufacture of printed circuits. 16th December, 1957. (876858.)

## 1958

1560. Philips Electrical Industries, Ltd.—Digital computers. 16th January, 1958. (876988.)  
2197. Arithmetic units for digital computers. 22nd January, 1958. (876989.)

2146. United Kingdom Atomic Energy Authority.—Fuel elements for nuclear reactors. 4th December, 1958. (876551.)

4486. Siemens-Schuckertwerke A.G.—Electrically insulating member for a high voltage cable straight joint or sealing end or a bushing insulator. 11th February, 1958. (877055.)

5547. Standard Telephones & Cables, Ltd.—Anode support structures in electron discharging tubes. 10th March, 1958. (876518.)

10253. Philips Electrical Industries, Ltd.—Electrolytic capacitors. 31st March, 1958. (876764.)

10858. Philips Electrical Industries, Ltd.—Methods of manufacturing semi-conductive devices. 3rd April, 1958. (876744.)

16489. Siemens-Schuckertwerke A.G.—Electromagnetic radiation control devices. 22nd May, 1958. (876746.)  
18827. Circuit arrangement for supplying a d.c. load through rectifiers and for protecting the rectifiers against over-currents. 12th June, 1958. (876787.)

18883. Akerman, O., and Akerman, L. O.—Electromechanical power transmission system. 12th June, 1958. (876884.)

20178. Marconi's Wireless Telegraph Co., Ltd.—Piezo-electric crystals. 5th March, 1959. (876997.)

20925. Ericsson Telephones, Ltd.—Electric pulse counting arrangements. 25th June, 1959. (876490.)

21293. Standard Telephones & Cables, Ltd.—Semiconductor devices. 26th June, 1959. (877422.)

21380. Elektromisk A.S.—Electrical connection of a single-phase furnace to a three-phase supply. 3rd July, 1958. (876886.)

22199. Deutsche Gold- und Silber-Scheideanstalt.—Gold alloys, for use as material for electric resistances. 10th July, 1958. (876887.)

22291. International Business Machines Corporation.—Electronic binary adders. 11th July, 1958. (Addition to 793799.) (877171.)

22478. Eitel-McCullough, Inc.—Electron beam tube. 14th July, 1958. (877506.)

22660. Transformatorenwerk K. Liebknecht Veb.—High voltage transformers. 15th July, 1958. (877587.)

23898. Bendix Corporation.—Electric device responsive to the magnitude of a d.c. signal. 24th July, 1958. (877435.)

24893. Soc. de l'Accumulateur Fulmen.—Charge regulator for electric accumulators. 1st August, 1958. (877298.)

25357. Siemens & Halske A.G.—Moisture-proof semiconductors. 7th August, 1958. (876750.)

26483. Raytheon Co.—Electron beam scanning systems. 18th August, 1958. (877436.)

28180. Boyd, Ltd., Winnett.—Fuel charging and discharging apparatus for a nuclear reactor. 1st September, 1959. (877423.)

29792. Associated Electrical Industries, Ltd.—Telephone instruments. 4th September, 1959. (876641.)

30329. Igranic Electric Co., Ltd.—Electrical energy transfer apparatus. 23rd September, 1958. (876888.)

30587. General Electric Co., Ltd.—Protective arrangements for electric motors. 22nd September, 1959. (877494.)

31685. Associated Electrical Industries, Ltd.—Eddy current coupling or braking devices. 2nd October, 1959. (877437.)

32935. Associated Electrical Industries, Ltd.—Radar display systems. 1st December, 1959. (877159.)

32937. Associated Electrical Industries, Ltd.—Pulse generators. 15th October, 1959. (876789.)

34545. Johnson, Matthey & Co., Ltd.—Thermocouples. 15th January, 1960. (876553.)

38165. Schneider, H. W.—Cord or chain operated electric pull switches. 12th November, 1959. (876969.)

38349. Associated Electrical Industries, Ltd.—Electronic switching circuit arrangement. 27th November, 1959. (876791.)

40707. Marconi's Wireless Telegraph Co., Ltd.—Electron beam focusing and aligning systems for electron beam tubes. 2nd September, 1959. (876971.)

## 1959

1900. General Electric Co., Ltd.—Electric radiant heaters. 14th January, 1960. (876555.)

2304. Head, Wrightson & Co., Ltd.—Safety link incorporated in an electric side restraint link for nuclear reactors. 8th January, 1960. (876890.)

2584. Giles, E. V.—Fabrics containing electric resistances and apparatus for making

them. 25th January, 1960. (Cognate application 32540, 24th September, 1959.) (876929.)

3100. British Rototherm Co., Ltd.—Electromechanical switching assemblies. 4th January, 1960. (876974.)

3240. Landis & Gyr A.G.—Temperature feeler with temperature responsive electrical member. 29th January, 1959. (876556.)

4056. Wolff, H. W.—Circuit-breakers. 4th February, 1960. (Addition to 779625.) (876769.)

5174. Associated Electrical Industries, Ltd.—Bonding glands for electric cables. 13th February, 1959. (Addition to 805850.) (876720.)

7755. Hughes Aircraft Co.—Method of producing semiconductor devices. 5th March, 1959. (876819.)

10910. Dehn, S. G. (Reimers Electric Appliance Co., Inc.).—Electrically heated steam generators. 31st March, 1959. (876976.)

15096. Clark Equipment Co.—Control systems for electric motors. 4th May, 1959. (876726.)

19493. Igranic Electric Co., Ltd.—Electrical control apparatus. 8th June, 1959. (876896.)

25910. Air Reduction Co., Inc.—Electric arc welding. 28th July, 1959. (876729.)

26961. Otto, S.—Electromagnetic packing apparatus. 6th August, 1959. (876835.)

## 1960

6450. Landers, Frary & Clark.—Thermostatic electrical switching device. 24th February, 1960. (876945.)

6737. Servais, L.—Apparatus for massage by electric vibrations. 25th February, 1960. (877548.)

7378. General Electric Co.—Magnetron output coupler. 2nd March, 1960. (877394.)

13963. Rumania, Minister for Heavy Industry of.—Electromagnetic welding jig for submerged arc welding of metals. 21st April, 1960. (877045.)

15446. Carrier Corporation.—Thermoelectric generator. 2nd May, 1960. (876474.)

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# CONTRACT INFORMATION

## Accepted Tenders and Prospective Electrical Work

### CONTRACTS OPEN

**Argentina.**—Yacimientos Carboníferos Fiscales. 23rd October. Power station extension. (E.S.B. 28526/61.)\*

**Australia.**—State Electricity Commission of Victoria. 16th October. 22 kV transformer for Morwell power station. (E.S.B. 28519/61.)\*

**Blackpool.**—Fylde Water Board. 13th October. Electrical installation, Wyre Lane pump house, Garstang, and lime dosing pump and pH control equipment. (See Classified Advertisement Section.)

**Brazil.**—Urban Transport Company, Recife. 25th September. 130 trolley-buses. (E.S.B. 28258/61.)\*

**Burma.**—Purchase Board. 2nd October. Cables. (E.S.B. 28838/61.)\* Fluorescent lamps. (E.S.B. 28836/61.)\*

**Ceylon.**—Department of Government Electrical Undertakings. 17th October. Metering sets. (E.S.B. 28531/61.)\* Insulators. (E.S.B. 28532/61.)\*

**India.**—Delhi Electric Supply Undertaking. 30th September. Cable. (E.S.B. 28561/61.)\* Punjab State Electricity Board. 23rd October. Transmission line equipment. (E.S.B. 28562/61.)\*

**Korea.**—Government Office of Supply. 10th October. Transmission line equipment. (E.S.B. 28541/61/I.C.A.)\*

**Midlothian.**—County Council. 13th October. Sodium street lighting. (See Classified Advertisement Section.)

**New Zealand.**—Dunedin City Council. 2nd March, 1962. Power distribution supervisory and control system. (E.S.B. 28586/61.)\*

**Norway.**—Joint Signals Administration. 25th November. Semi-automatic telegraph relay equipment. Applications to tender by 25th September. (G.D. 159/60(31).)†

**Pakistan.**—West Pakistan Water and Power Development Authority, Lahore. 2nd October. All-aluminium conductors. (E.S.B. 28260/61.)\* High voltage underground cables. (E.S.B. 28264/61.)\* 3rd October. A.s.c.r. conductors. (E.S.B. 28261/61.)\* 5th October. kWh meters. (E.S.B. 28504/61.)\* 66 kV insulators. (E.S.B. 28266/61.)\* 33 kV insulators. (E.S.B. 28265/61.)\* 6th October. Low voltage underground cables. (E.S.B. 28267/61.)\* 9th October. Voltmeters and kWh meters. (E.S.B. 27973-4/61.)\* 10th October. kWh meters. (E.S.B. 28505/61.)\* Director of Supply, Dacca. 3rd October. Circuit-breakers, switch-fuses, distribution boards, etc. (E.S.B. 28573/61.)\*

**Turkey.**—State Hydraulic Works. 7th December. Transformers. (E.S.B. 28802/61.)\*

**United States.**—United States Corps of Engineers, Little Rock District. 10th October. 825 h.p. hydraulic turbine for Beaver powerhouse. (E.S.B. 28554/61.)\*

### ORDERS PLACED

**Glasgow.**—Highways Committee. Electrical plant and equipment for the Clyde Tunnel, Contract No. 3 (£211,914).—James Scott & Co. (Electrical Engineers).

**Ilford.**—Corporation. Recommended. Stage IV of lighting scheme for district roads (£27,452).—Midland Electrical Contractors.

**Stockport.**—Corporation. Electrical engineering services for Phase II of the Stockport College of Further Education (£38,316).—Piggott & Whitfield.

### WORK IN PROSPECT

*Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors*

**Amersham.**—Church, Woodside Road; McMorran & Whitby, architects, 14, North Audley Street, London, W.1.

**Argyllshire.**—Council offices, Dunoon (£73,000); county architect, County Offices, Dunoon.

**Aylesbury.**—Weedon Road Junior School (£234,920); county architect, County Offices, Aylesbury.

**Basildon.**—Arts and crafts block, Fryerns Technical School; D. Clarke Hall, architect, 6, Mason's Yard, London, S.W.1.

**Basingstoke.**—Maisonnettes (80), South Ham; borough architect.

**Belford (Northumberland).**—R.C. church; Reavell & Cahill, architects, Lloyds Bank Chambers, Alnwick.

**Bilston.**—Swimming baths, Prouds Lane; Simister & Marshall, architects, 38, Congreve Street, Birmingham.

**Birmingham.**—Works, Lower Tower Street; Cowdrill Bros., Ltd., 5, Guilford Street.

**Bishop's Stortford.**—Town hall, Council offices, fire station, etc., in connection with new civic centre; surveyor, Council House, The Causeway.

**Bletchley.**—Fire station and northern divisional headquarters; county architect, County Offices, Aylesbury.

**Bristol.**—Additional printing works; Purnell & Sons, Ltd., Paulton.

**Bury St. Edmunds.**—Home for the aged, Hospital Road; county architect, 13, Westgate Street, Bury St. Edmunds.

**Carlisle.**—New laundry and boilerhouse at the General Hospital; L. G. Mouchel & Partners, consultants, 24, Claremont Place, Newcastle-on-Tyne.

**Cheltenham.**—Three-storey extensions, Liverpool Place/High Street site, for F. W. Woolworth & Co., Ltd.; chief architect, Woolworth House, Marylebone Road, London, N.W.11.

Houses (47), Arle Road; Western Estates, Ltd., Norwood Road.

**Chipping Campden.**—Administration, two-storey science and classroom blocks, etc., at Grammar School; county architect, Shire Hall, Gloucester.

**Clacton-on-Sea.**—Thirteen-storey block of 88 flats for Corporation; borough surveyor.

**Coalville.**—£200,000 sewage treatment works at The Sharrows; surveyor, Coalville, Leics.

**Cumberland.**—Secondary school at Longtown (£162,000), old people's home for North East Cumberland, and family unit home at Penrith; D. Dickinson, county architect, Portland Square, Carlisle.

**Darlington.**—R.C. primary school, Kingsway; Crawford & Spencer, architects, 91, Borough Road, Middlesbrough.

Shopping developments, Skinnergate, for the Maypole Dairy Co.; Firmin & Partners, architects, Thavies Inn House, Holborn Circus, London, E.C.1.

**Doncaster.**—Scheme for bowling alley, shops, offices, flats, etc., Sunny Bar site; Industrial & Investment Services, Ltd., 129, Finsbury Pavement, London, E.C.2.

**Dorsetshire.**—Upton Primary School, second section of Blandford Camp Primary School and extensions to Ferndown and Kemp Welch Modern Schools; county architect, County Hall, Dorchester.

**Dudley.**—Houses (272), Russells Hall estate, and shops (17), Fisher Street and Castle Street; borough architect, 5, Ednam Road.

**Durham.**—Houses (26), Grape Lane, Crossgate, for T.C.; Tarren & Caller, architects, Sedgfield.

**Edinburgh.**—Development of Waverley Station, including administrative buildings, offices, shops, etc.; Murrayfield Real Estate Co., Ltd., 7, Albyn Place, Edinburgh.

**Epsom.**—Group laboratory, West Park Hospital; Howes & Jackman, architects, 1, Verulam Buildings, Gray's Inn, W.C.1.

**Falkirk.**—Municipal buildings, Westbank site; B. Bercoot, architect, 118, Blythswood Street, Glasgow.

**Frimley and Camberley.**—Houses (132), Old Dean Common estate, overspill housing scheme; Close & Morton, 20-22, High Street, Camberley, Surrey.

**Gateshead.**—Proposed new R.C. school; Hedley & Thompson, solicitors, 11, Toward Road, Sunderland.

**Glasgow.**—Development of two industrial estates, Balmore and Sighthill; Architects' Department, Municipal Buildings, George Square.

**Gloucester.**—Works extensions; Hoffman (Gloucester), Ltd., Stonehouse.

**Gloucestershire.**—Fire station at Paganhill Lane, Stroud (£90,000) and extensions to Hartbury Farm Institute (£172,396); county architect, Shire Hall, Gloucester.

**Golders Green.**—Petrol and service station for A. Pannell, Ltd., Finchley Road; Varney & Co., Ltd., Creden House, Verney Road, S.E.16.

**Hampshire.**—Secondary school, Eastleigh; dental clinic, Alton County Secondary School; training centre and hostel, Basingstoke; extensions, Mount Industries, Bishopstoke; County Road Depot, Bishop's Waltham; office, Andover. County architect, The Castle, Winchester.

**Hampton.**—Methodist church, Percy Road; H. & H. M. Liddbetter, architects, 2, Verulam Buildings, Gray's Inn, W.C.1.

**Hastings.**—Factory and offices, Broomgrove; W. M. Still & Sons, Ltd., 29, Greville Street, London, E.C.1.

**Hatfield.**—Methodist church, Oxlease area; Geo. Baines & Syborn, architects, 121, Victoria Street, London, S.W.1.

**Havant and Waterloo.**—Houses (214), Milton Road, Waterloo; U.D.C. surveyor, Park Road North, Havant.

**Hazel Grove.**—Houses (60), Bramhall Moor Lane; J. J. Oakes & Son, Ltd., Dialstone Lane, Stepping Hill, Stockport.

**Henley-on-Thames.**—Dwellings (51), Vicarage Road; borough engineer.

**Hertford.**—Houses and flats (32), as first instalment of Horns Hill redevelopment; borough surveyor, The Castle.

**Hunts.**—Junior school, Spring Common; county architect, Huntingdon.

**Inverness.**—Shops, departmental store, hotel, restaurant, library, etc., in connection with redevelopment of Bridge Street; Ian Burke, architect, 11, South Tay Street, Dundee.

**Jarrow.**—Houses (110), Hedworth; borough engineer.

**Kingston-on-Thames.**—17 four-storey maisonnettes as first stage of redevelopment

\* This information is extracted from the Board of Trade Export Service Bulletin. Inquiries should be addressed to the Board of Trade, Export Services Branch, Lacon House, Theobald's Road, London, W.C.2 (Telephone: Chancery 4411, Ext. 738), quoting the reference given. †Telephone: Trafalgar 8855, Ext. 2010.



scheme, Acre Road; borough surveyor, Guildhall.

**London.**—Office block, Moor Lane; Joseph, Cashmore & Partners, architects, 3n, King's Bench Walk, Temple, E.C.4.

**Luton.**—Houses (55), Icknield Nursery; Pearce & Barker, Ltd., 71, Leagrave Road, Luton.

**Lymington.**—Bungalows (50); Anvil Properties, Ltd., Canford Chambers, St. Peters Road, Bournemouth.

**Newbury.**—Flats (30), Wentworth House, Stroud Green; surveyor, Town Hall.

**Northampton.**—Proposed sub-divisional police station on Wootton Hall estate (£54,000); county architect.

**Otterburn (Northumberland).**—Workmen's club; Williamson & Partners, architects, 7, St. Mary's Place, Newcastle-on-Tyne.

**Peterborough.**—Flats, maisonnettes and garages in St. Mary's Street and two blocks of flats on Bluebell estate; city engineer.

**Pittenweem (Fife).**—Ice factory, cold store, etc., Abbey Wall Road (£50,000); David Lawrie, James Street.

**Rutherglen.**—Houses (40), Fernhill; J. Russell, burgh surveyor, Town Hall Buildings, Rutherglen, Lanarkshire.

**Salisbury.**—Dwellings (144), Friary redevelopment; city architect.

Adaptations, Salisbury Isolation Hospital, Trowbridge; county architect.

**Scarborough.**—Houses (27), Eastfield; V. Forshaw, borough engineer.

**Scunthorpe.**—Dwellings (360) proposed, comprising houses and 16-storey flats; borough surveyor.

**Sedgefield.**—Houses (33) at Windlestone; R.D.C. housing architect.

**Sheffield.**—Hotel and shops, Cambridge Street; Shepherd, Fowler & Marshall, architects, 15, St. James's Row.

**Sherborne.**—Extensions to St. Aldhelms C.E. Secondary Modern School; Pether Warren & Roydon Cooper, architects, Georgian House, Greenhill, Sherborne.

**Shoreham.**—Additional factory; Beagle-Miles, Ltd., The Airport.

**Southport.**—Houses (56), Staveley Road, Ainsdale; town planning officer, 95/105, Lord Street.

**South Shields.**—Houses (107) in the Reading Road area, for the T.C.; W. Vet, Ltd., builders, Fulwell Road, Sunderland.

Premises for the Harlow Printing Works; C. Solomon, architect, 30, St. Mary's Place, Newcastle-on-Tyne.

**Spennymoor (Co. Durham).**—Factory additions for Industrial Estates Management Corporation; C. S. Errington, architect, 46, Grainger Street, Newcastle-on-Tyne.

**Staffordshire.**—Mental health centre at Bilston, adult hostel at Willenhall, and school for maladjusted boys at Ashley, Ecclesfield; director of education, Green Hall, Lichfield Road, Stafford.

**Stevenage.**—Factory (£145,000) for Taylor Controls, Ltd., Walthamstow; A. Monk & Co., Ltd., 75, Victoria Street, S.W.1.

**Stockton-on-Tees.**—Housing developments near Junction Road, Norton; Appleton & Hall, estate agents, 134, High Street.

**Sunderland.**—Offices and canteen; H. Young (Motors), Ltd., Front Street, Chester-le-Street.

**Tamworth.**—Dwellings (287); Gregory Housing, Ltd., 51, Farncombe Road, Worthing.

**Taunton.**—Shops and flats, Holway estate; H. S. W. Stone & Partners, architects, 20, The Crescent.

**Teignmouth.**—Theatre and conference hall, Carlton Terrace; Louis de Soissons, Peacock, Hodges, Robertson & Fraser, architects, 12, Baring Crescent, Exeter.

**Tickhill.**—Houses (32), Vine Road estate extension; J. Haslam & Sons, architects, Ryton Chambers, Newcastle Avenue, Worksop.

**Tonbridge.**—Dwellings (77), Parkway estate; Durnell Garden Estates, Ltd., St. John's Hill, Sevenoaks.

**Twickenham.**—Thirteen-storey block of flats, Wick Road, Hampton Wick; borough engineer, Municipal Offices.

**Wallingford.**—Group stores and occupational therapy department, Fair Mile Hospital; Morton Lupton, architect, 1, Church Street.

**West Hartlepool.**—Proposed Fens Junior School for the E.C.; A. G. Sinclair, borough architect.

**West Kirby.**—Church of St. Michael and All Angels, Frankby Road, Newton; Paterson & Macaulay, architects, 83, Wirral Gardens, Bebington.

**Wigan.**—Four-storey offices, Bridgeman Terrace; Norwich Union Insurance Society, Norwich.

**Winchester.**—Eight-storey headquarters building, West Hill, for Police Authority; county architect, The Castle, Winchester.

**Wolverhampton.**—Extensions for Manifoldia, Ltd., Bromford Lane; T. Elvins & Sons, Ltd., Naden Works, Birmingham.

**Worcestershire.**—Scheme for establishment of a teaching farm (£100,000) and hostel for 60 students and staff houses as completion of Pershore Institute; director of education, Castle Street, Worcester.

**Workington.**—Houses (240); borough engineer.

**Worksop.**—R.C. school, Netherton Road (£70,000); Sandy & Norris, architects, 134, Newport Road, Stafford.

**Worthing.**—Erection of pavilion at Palatine Road; L. H. Fewster & Gamble, architects, 5, Liverpool Gardens, Worthing.

## NEXT WEEK'S EVENTS

*Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 243a, Dorset House, Stamford Street, London, S.E.1, to ascertain that the proposed dates for their functions do not clash with others already arranged*

### MONDAY, 18th SEPTEMBER

**Birmingham.**—Grand Hotel, 6.15 p.m. Birmingham Electric Club. "Power Cables," by A. R. Leith. Presidential address.

**Bristol.**—Grand Hotel, 8 p.m. A.S.E.E. Bristol and West of England Branch. Chairman's address and "Trends in Technical Education," by E. J. Mathieson.

**Chelmsford.**—White Hart Hotel, Tindell Street, 7.45 p.m. A.S.E.E. Mid-Essex Branch. "The A.S.E.E.: Its Work and Its Future," by E. A. Bromfield.

### TUESDAY, 19th SEPTEMBER

**Leicester.**—Westcotes Constitutional Club, 124, Wilberforce Road, 7.30 p.m. A.S.E.E. Leicester Branch. "Subscriber Trunk Dialling," by C. G. Lloyd.

**Oxford.**—Employment Exchange, St. Aldates, 7.30 p.m. A.S.E.E. Oxford and Districts Branch. "Present-day Applications and Recent Developments in Water Heating."

**Reading.**—Social Club, Caversham, 7.30 p.m. A.S.E.E. Reading and Districts Branch. Programme of stereo recordings.

**Stoke-on-Trent.**—North Stafford Hotel, 6 p.m. for 6.30 p.m. I.E.S. Stoke-on-Trent Group. "The I.E.S. Code," by P. Hartill and G. O. Edwards.

**York.**—Royal Station Hotel, 7.30 p.m. A.S.E.E. York Branch. "Electric Floor Warming," by R. Bradbury.

### THURSDAY, 21st SEPTEMBER

**Blackburn.**—Castle Hotel, 7.30 p.m. Institution of Plant Engineers, Blackburn Branch. "Shell Boiler Developments," by A. D. C. Gunn. Joint meeting with North Western Section, Institute of Fuel.

**Grangemouth.**—Leapark Hotel, Bo'ness Road, 7 p.m. Society of Instrument Technology, Grangemouth Section. "Theoretical Aspects of Control Engineering," by J. M. Keating.

**London.**—Radiation Showrooms, Radiation House, 59-65, Baker Street, W.1, 2.30 p.m. Electrical Association for Women, London Branch. Visit.

**Loughborough.**—College of Further Education, Green Close Lane, 6 p.m. Institute of Marine Engineers, West Midlands Section. "Diesel-Electric Installation for Propulsion and Cargo Handling of the Bulk Cement Carrier John Wilson," by H. E. Muckley and J. G. Derrington.

### SATURDAY, 23rd SEPTEMBER

**London.**—Houses of Parliament. A.S.E.E. South West London Branch. Tour.

## Trade Mark Applications

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 6th October.

**Waste King Universal.** No. 806,369. Class 7. Dish-washing machines and laundry machines.—Waste King Corporation, U.S.A. Address for service: Stevens, Langner, Parry & Rollinson, 5-9, Quality Court, Chancery Lane, London, W.C.2.

**Singer.** No. 788,470. Class 9. Electrical terminal plugs, capacitors, connectors, switch-boxes, transformers and needle-temperature indicators for electric sewing machines, and motors therefor; and electric flat-irons. Also No. 788,471. Class 11. Lamps and lighting fittings for use on sewing machines.—Singer Manufacturing Company, U.S.A. Address for service: Cruikshank & Fairweather, 29, St. Vincent Place, Glasgow, C.1.

**Sunbeam.** No. 805,765. Class 8. Electrical, electronic, radio and television, measuring, recording, signalling and calculating apparatus and instruments.—Sunbeam Corporation, U.S.A. Address for service: Frank B. Dehn & Co., Imperial House, 15-19, Kingsway, London, W.C.2.

**Pac-Sol.** No. 806,134. Class 9. Electromagnetic apparatus. **Licon.** No. 806,135. Class 9. Electric current interruptors, solenoids, relays and transducers, all being parts of control apparatus; and electric switches.—Illinois Tool Works, U.S.A. Address for service: Gill, Jennings & Every, 51-52, Chancery Lane, London, W.C.2.

**Splendy.** No. B817,262. **Lucky.** No. 817,263. Class 9. Electrical apparatus and instruments.—"Holland Electro," Rotterdam. Address for service: Marks & Clerk, 57 and 58, Lincoln's Inn Fields, London, W.C.2.

**Corodyne.** No. 817,337, and **Coroplast.** No. 817,878. Class 9. Insulated electric cables and conductors, electric wiring harnesses for motor vehicles, and plug connections.—Fritz Muller "Coroplast" K.G., Germany. Address for service: H. A. L. Venner, 1, Great James Street, Bedford Row, London, W.C.1.

**Parmar.** No. 814,510. Class 11. Lighting installations, parts and fittings.—W. J. Parry & Co. (Nottingham), Ltd., Victoria Mills, Draycott, Derbyshire.





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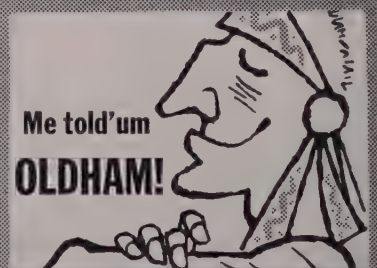
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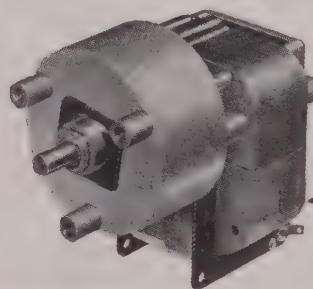
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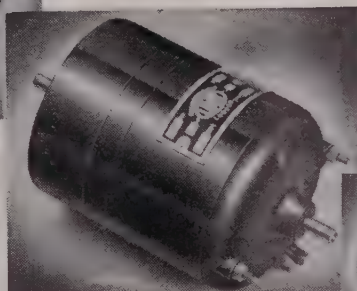
Shaded Pole



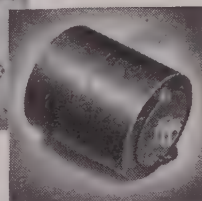
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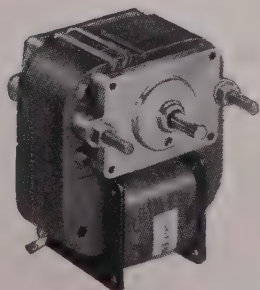
Shaded Pole Skeleton Frame Geared Units



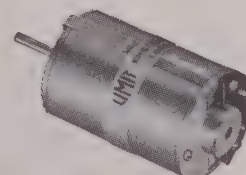
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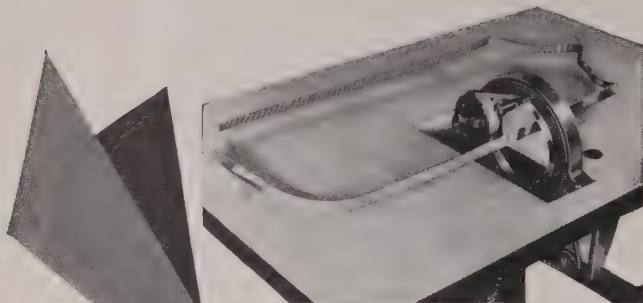


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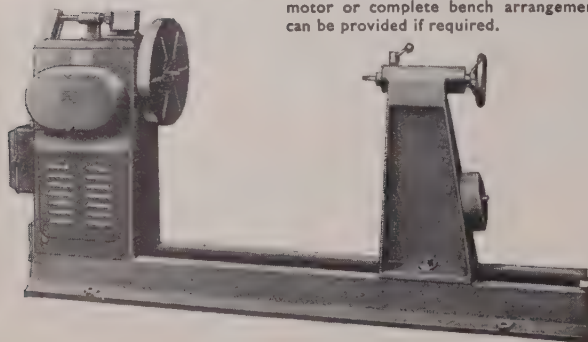
machines



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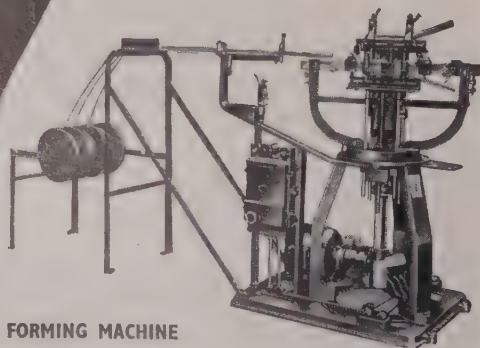
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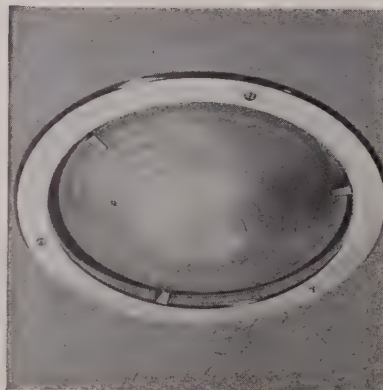
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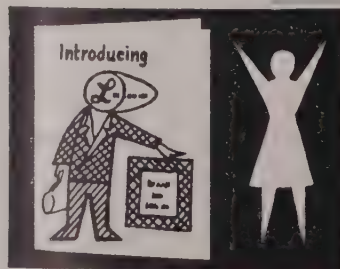


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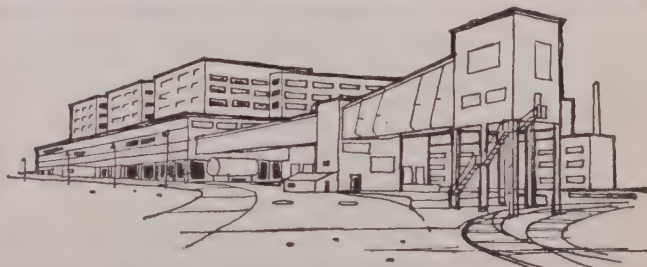
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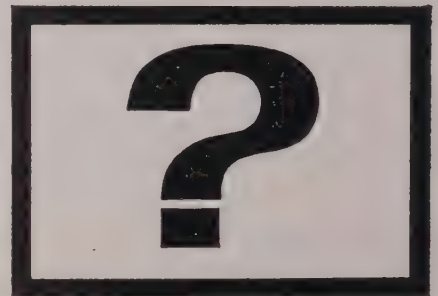
OIL



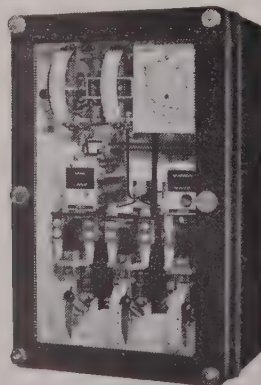
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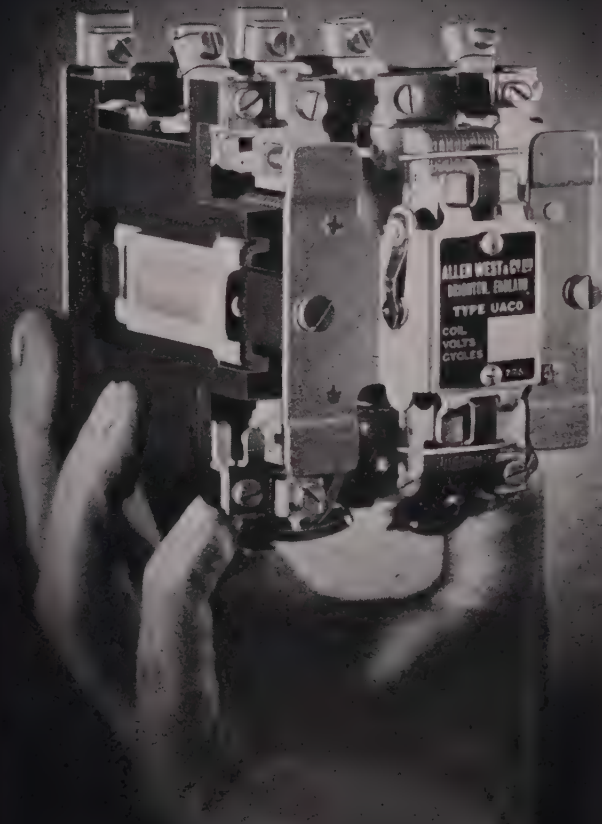


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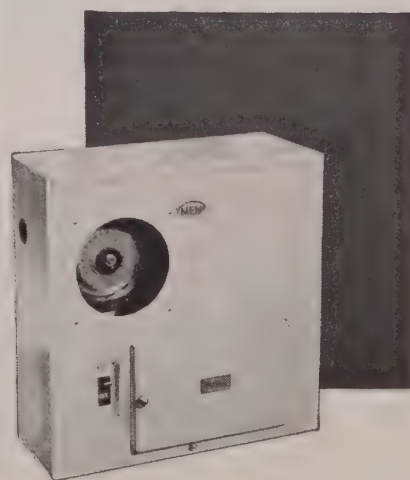
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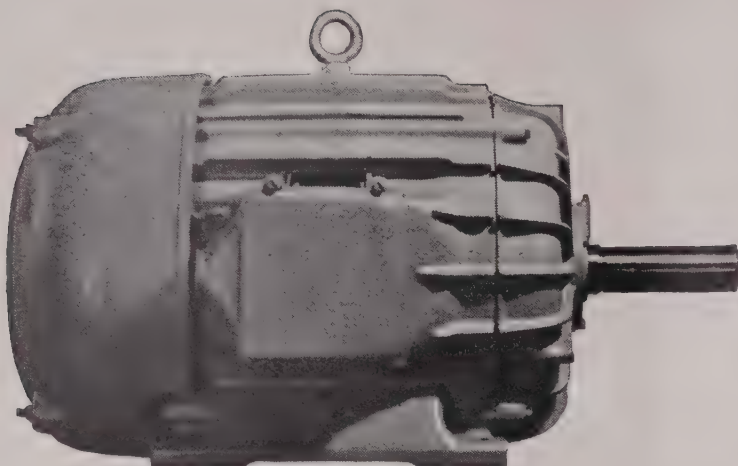
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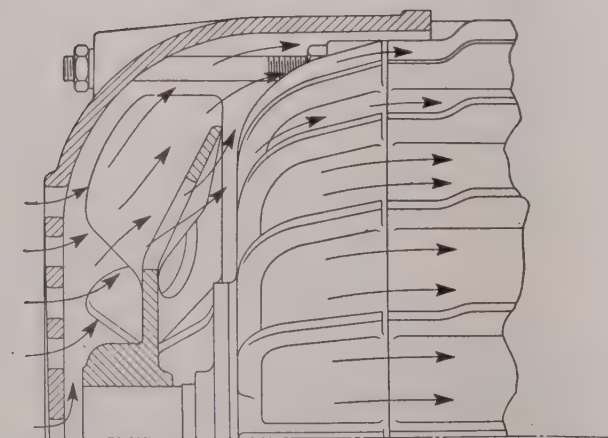
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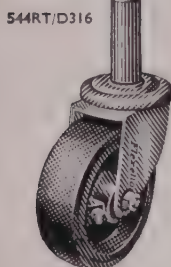
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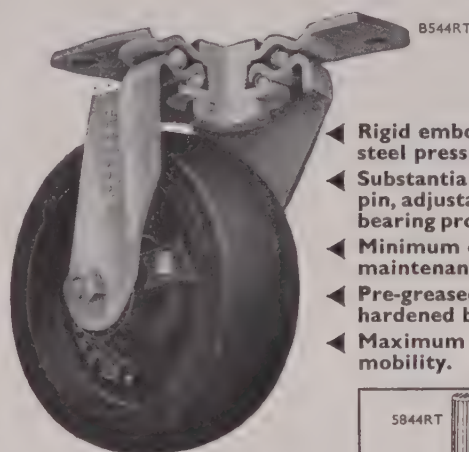
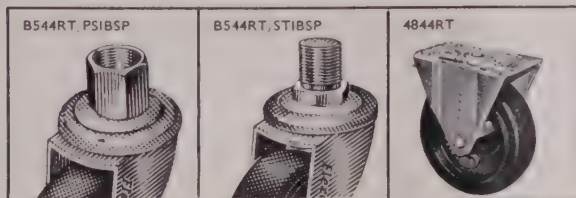


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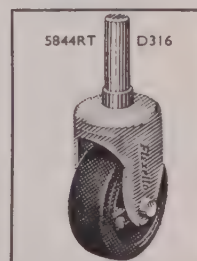
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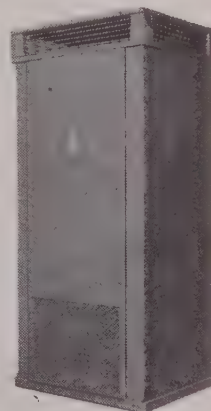
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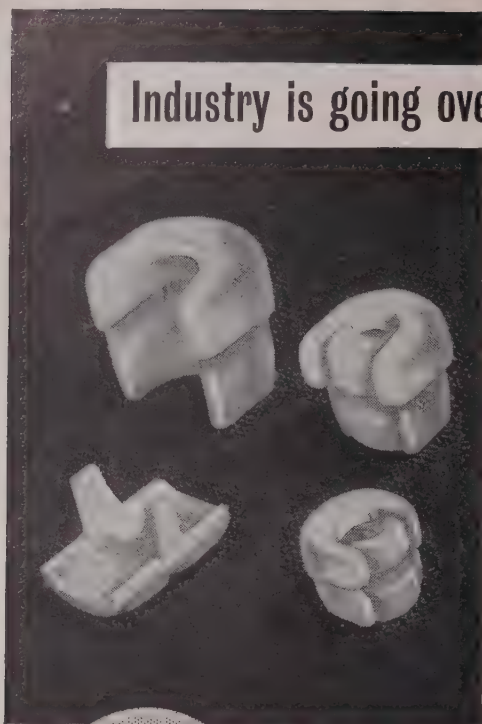
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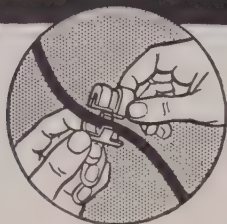
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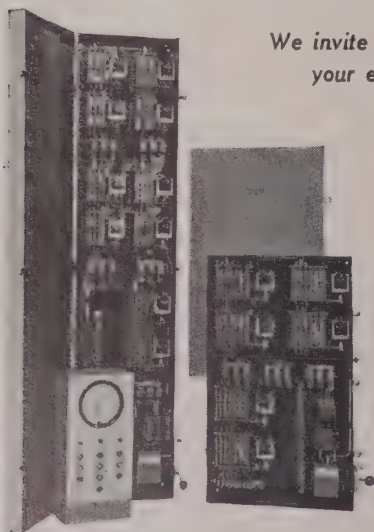
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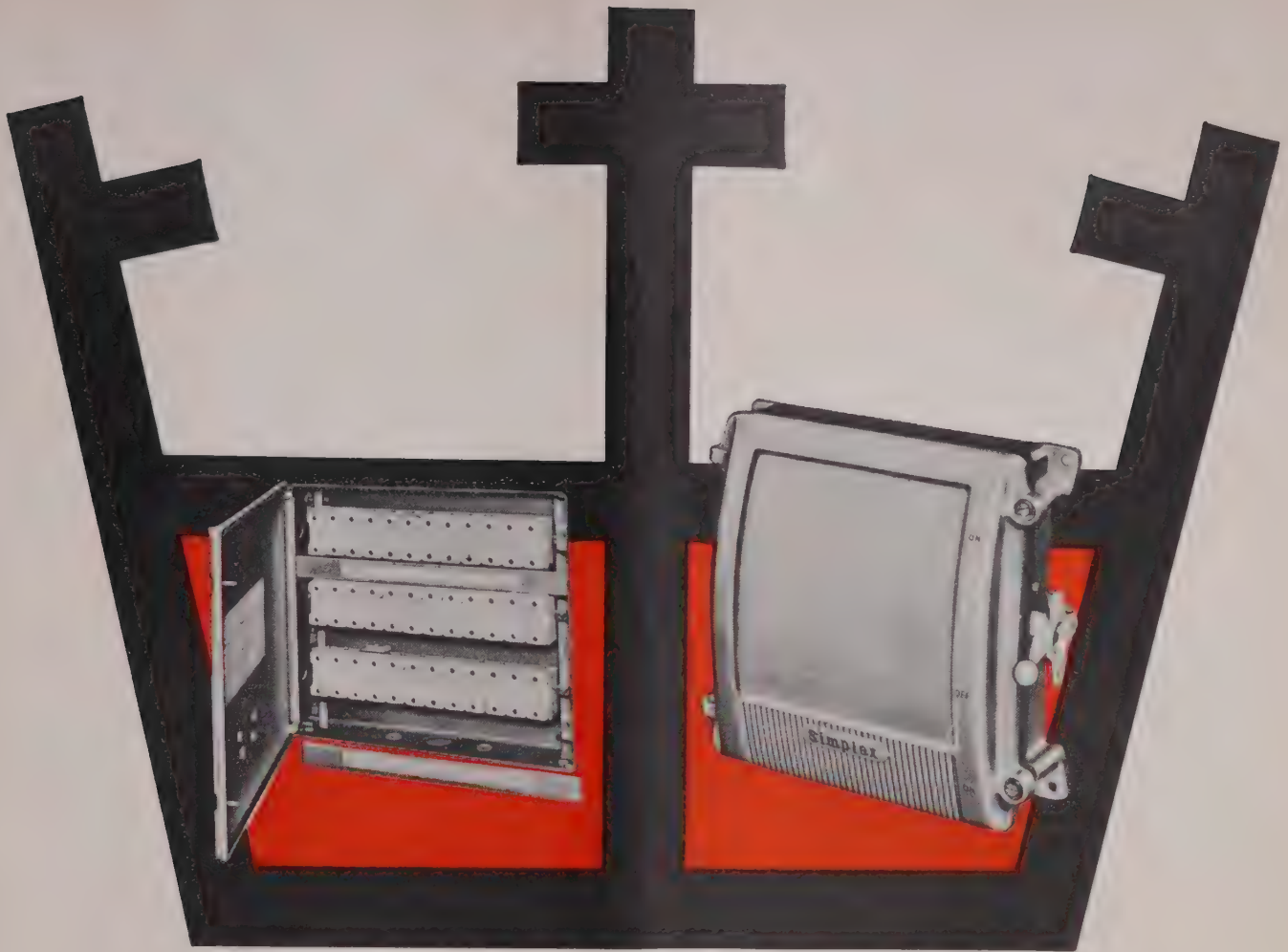
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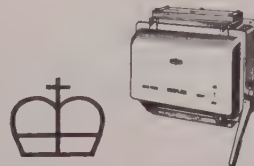
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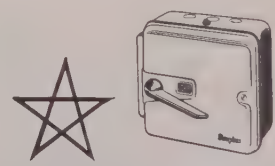
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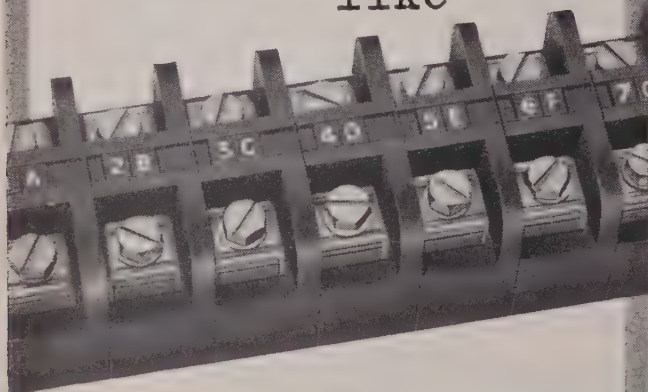
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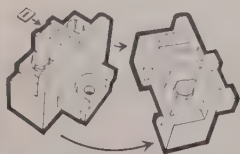


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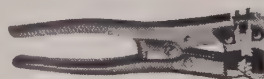


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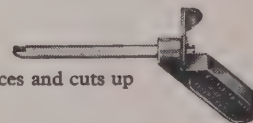
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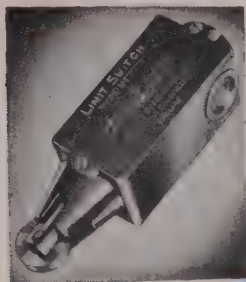
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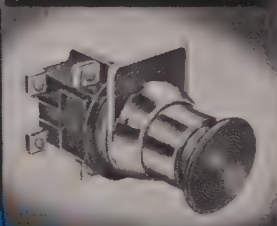
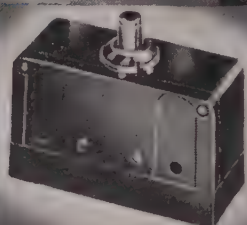
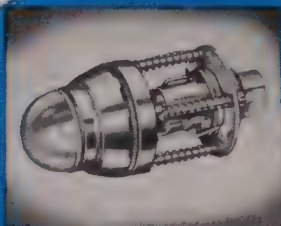
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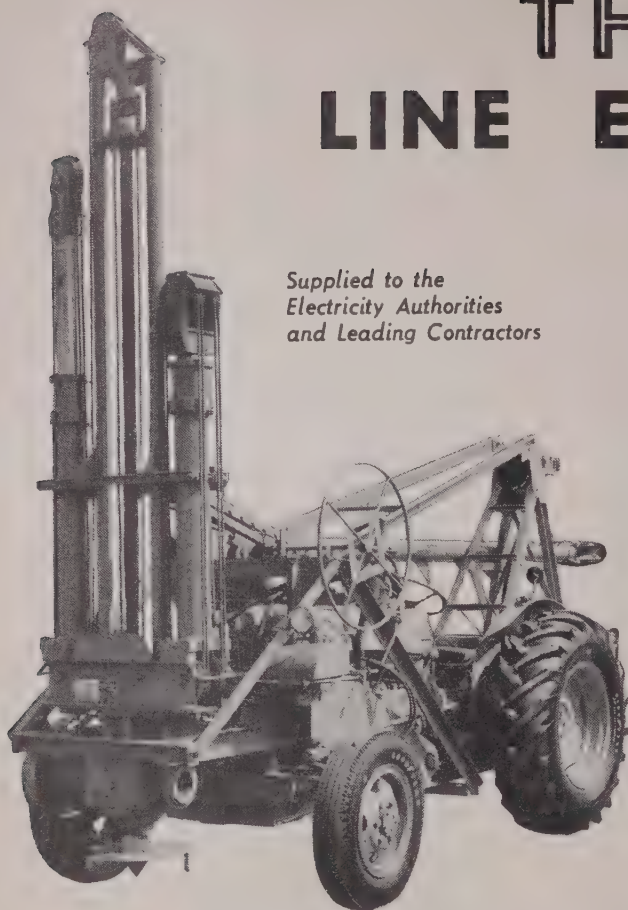
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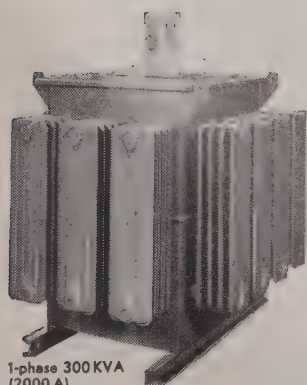


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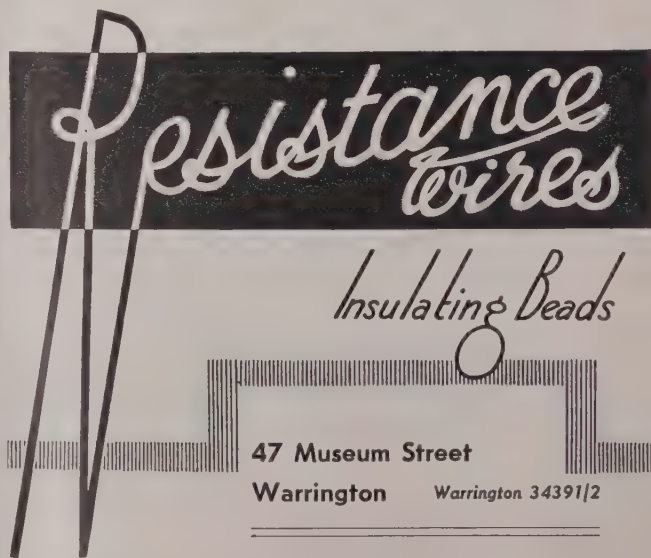
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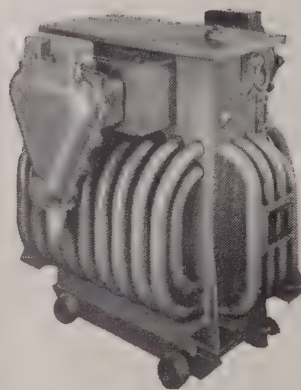


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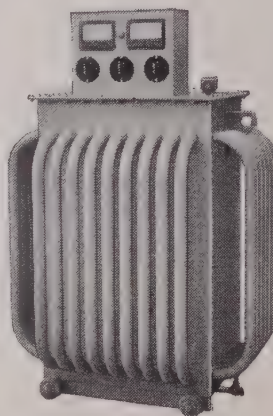
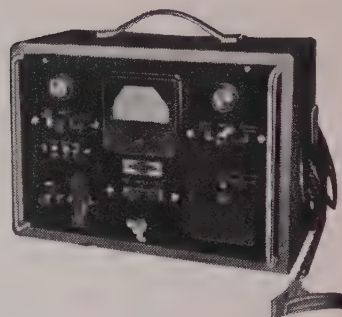
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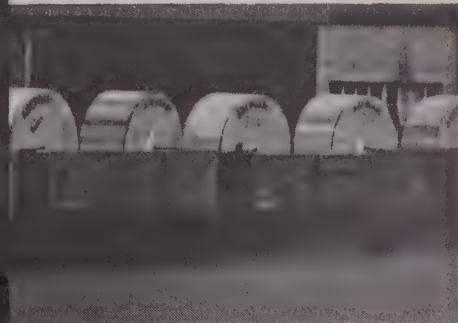
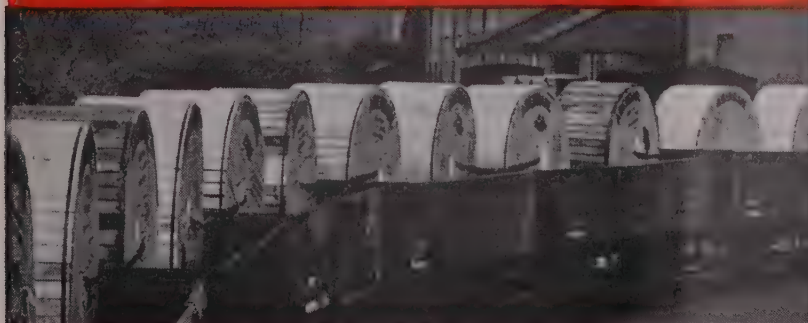


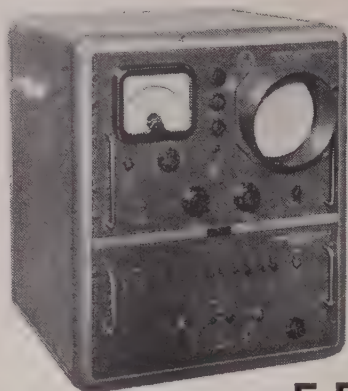
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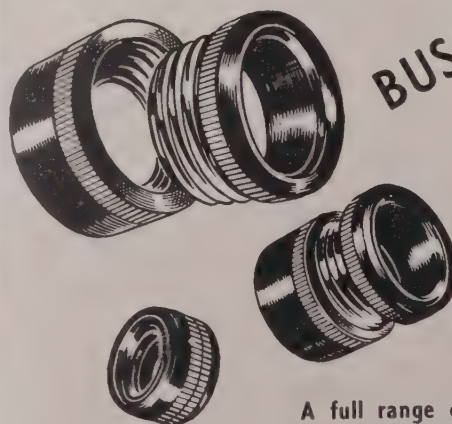
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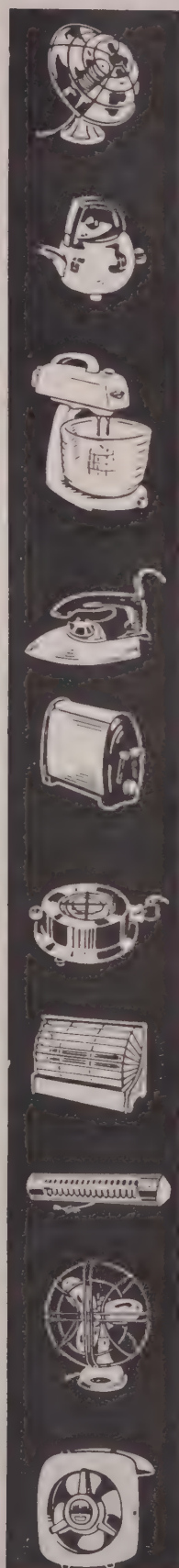
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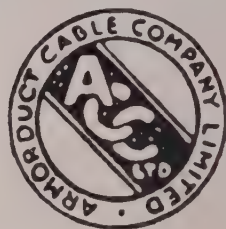
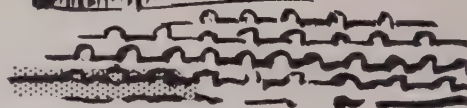
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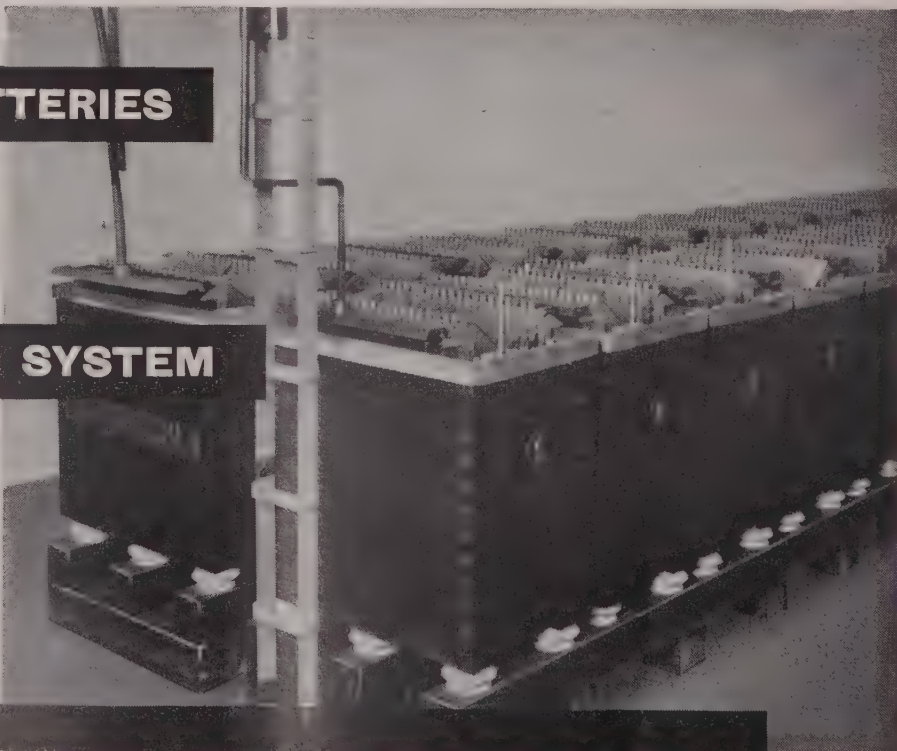
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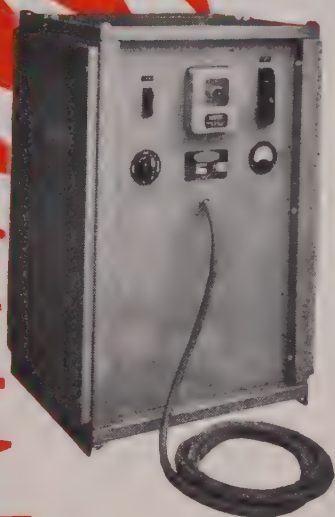
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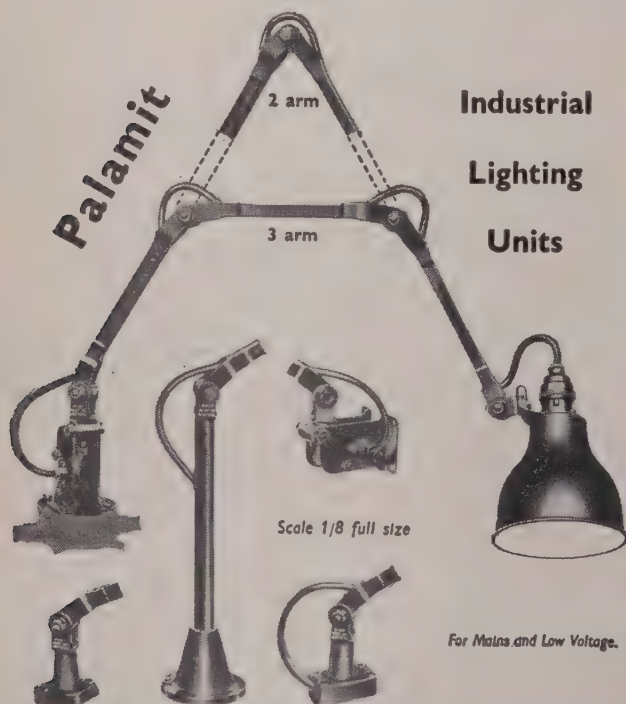
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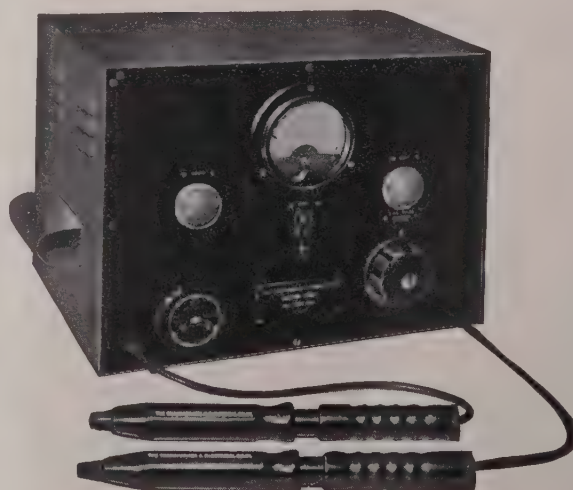
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 Telephone: Basildon 20491/3



# DENISON

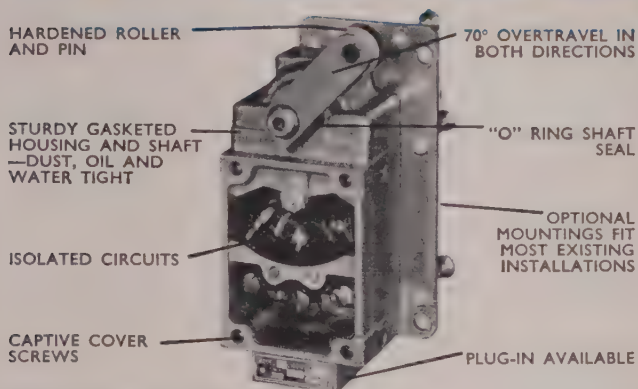
## LOXSWITCH



### STANDARD OF RELIABILITY

*in limit switches for machine  
tools and handling equipment*

#### MODEL L100W heavy duty



**HIGH CONTACT PRESSURE** Twice as much contact pressure.

**LONG CONTACT LIFE** Lowest impact, minimum "bounce".  
Weight of contact units (mass at impact) 2.45 grams.

**70° SAFETY OVERTRAVEL**

**WATER, DUST AND OIL TIGHT**

**MEDIUM OPERATING FORCE** Greatly reduced wear.

**SIMPLICITY OF DESIGN** Ease of maintenance, few working parts.

**INTERCHANGEABILITY** Switch mountings and levers fit most existing installations.

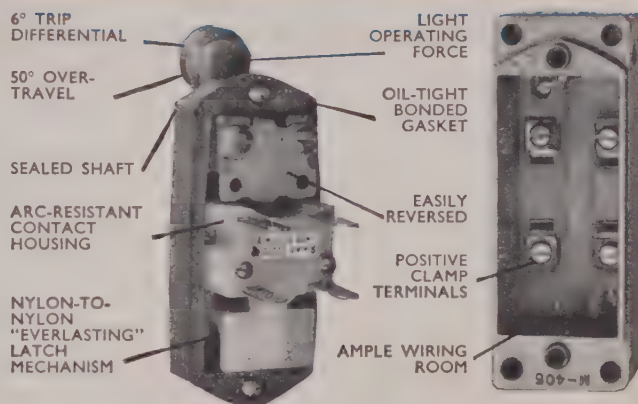
**LEVERS** 150 levers available.

**45 CONTACT ARRANGEMENTS**

##### AMPERE RATINGS

VOLTS	Normal		Inrush
	AC	DC	AC
125	30	5	60
250	15	2	30
Three circuit switches rated to 300 volts only			
Two circuit switches rated to 600 volts			
500	7.5		15
600	6	.4	12

#### MODEL M precision



**LONG MECHANICAL LIFE** Heavy duty nylon latch mechanism. Tested to 45,000,000 cycles under electrical load.

**WIDE CONTACT GAP**

**FULLY ISOLATED CIRCUITS** Positive double break, 1-NO, 1-NC.

**50° OVERTRAVEL** In both directions, only 6° trip differential.

**MANY LEVER STYLES** Wide choice for maximum adaptability.

**PLUG-IN MODELS**

##### AMPERE RATINGS

VOLTS	Normal		Inrush
	AC	DC	AC
125	20	3	60
250	15	1.5	30
500	7.5		15
600	6	.4	12

\* Registered trade mark of R.B. Denison Company, U.S.A.

Send for the **LOXSWITCH** leaflet

**EXPERT**  
INDUSTRIAL CONTROLS  
LIMITED

Lount Works

Ashby-de-la-Zouch

Leicestershire

Telephone: Ashby 422/3



**16 and 26 ampere**

**WESTINGHOUSE**

**Trinistor**

**silicon controlled rectifiers  
up to 400 volts rating**

	CS31	CS32
Maximum forward current, 180° conduction	26A	16A
Maximum surge current	580A	360A
Maximum mean gate power	0.5W	0.5W
Maximum sustaining current	50mA	25mA
Maximum forward or reverse leakage current	20mA	20mA
Typical turn on time	2μs	2μs
Typical turn off time	20μs	20μs

Maximum forward and reverse voltage, peak	25	50	75	100	150	200	250	300	350	400
16 ampere	CS32B	CS32C	CS32D	CS32E	CS32G	CS32J	CS32K	CS32L	CS32M	CS32N
26 ampere	CS31B	CS31C	CS31D	CS31E	CS31G	CS31J	CS31K	CS31L	CS31M	CS31N

Applications include, static switching, control systems, regulation and control of a.c. and d.c. supplies, static inverters, constant voltage supplies, etc.

*For further information write to*

Dept. ER9/61 Rectifier Division, Unit Section

**WESTINGHOUSE BRAKE AND SIGNAL CO. LTD., 82 York Way, King's Cross, London, N.1 TERminus 6432**





## For still *faster* silver brazing

JMC preplaced inserts—carefully sized and shaped pieces of brazing alloy—are being used on an increasing scale to speed up repetition silver brazing.

Ring shaped inserts in various JMC alloys

are now supplied in a new easy-strip packing that facilitates storage and saves time in handling on the bench—another example of Johnson Matthey leadership in this important field.

*Full technical information on JMC Low Temperature Silver brazing is available on request.*

**Johnson  Matthey**

LOW TEMPERATURE SILVER BRAZING ALLOYS

**JOHNSON, MATTHEY & CO., LIMITED, 73-83 HATTON GARDEN, LONDON, E.C.1**  
**Telephone: Holborn 6989**

**Victoria Street, Birmingham, 1. Telephone: Central 8004**

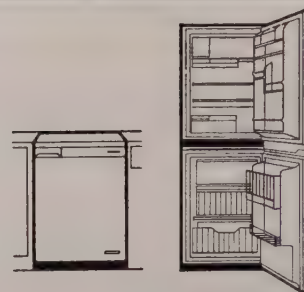
**75-79 Eyre Street, Sheffield, 1. Telephone: 29212**

# NEW!

Kenwood best-sellers in refrigeration—  
**FREEZER AND REFRIGERATOR TO MATCH!**



## BIG CAPACITY- LOW PRICE!



For the first time ever...complete refrigeration in two separate matched units...at really down-to-earth prices! The Kenwood HF 42A meets the growing demand for a *real* home deep-freezer—with 4.2 cubic feet of genuine sub-zero degree storage. And the matching Kenwood HR 52A Refrigerator packs in a full 5.2 cubic feet of storage for all weekly needs. Superbly designed, expertly planned to make the most of their big capacity, these two are your best sellers in refrigeration!

Side by side under one double-width table top (optional extra, main illustration)...one atop the other (right)... under a built-in counter or separately...left or right hand door opening...the Kenwood pair fit handsomely into any shape or size kitchen!

### RETAIL PRICES

FREEZER HF 42A	£60.14.10 + £11.14.2 PT
REFRIGERATOR HR 52A	£51.2.6 + £9.15.6 PT
OPTIONAL WORKING SURFACE	£33.0

## Every woman wants a



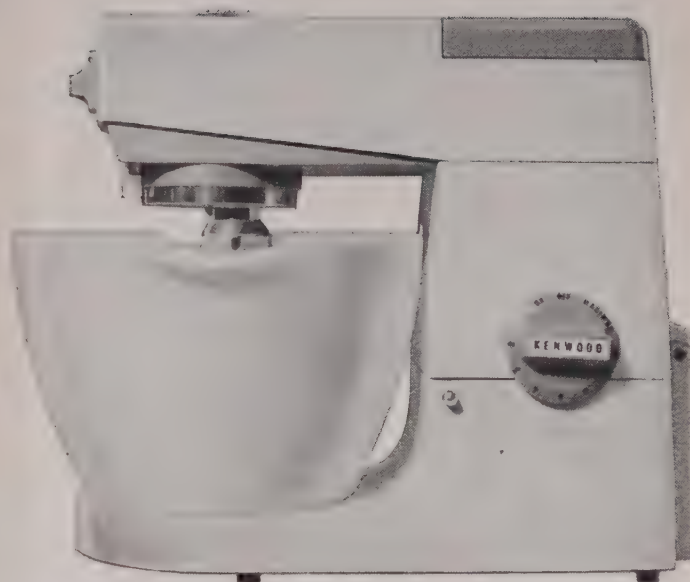
# Kenwood Chef-

## THE WORLD'S MOST WANTED FOOD PREPARATION MACHINE!

Women want the Kenwood Chef because no other machine has so many attachments—does so many difficult, time consuming and messy jobs for them. It helps with every meal—from a welsh rarebit to a four-course dinner! And once they've bought the basic Chef, they come back again to buy the Chef's attachments. Widely advertised in the national press, full-colour pages in leading magazines and at your local cinema...the famous Kenwood Chef is always in demand!

Kenwood Chef standard pack includes mixing bowl, three beaters, and 126-page recipe and instruction book.

RETAIL PRICE £24.9.7 + £4.18.5 PT



## NEW! Kenwood Chefette

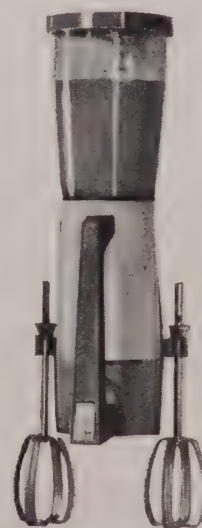
*Backed by TV and press advertising, this modestly-priced, outstandingly designed and useful machine is certain to have a phenomenal sales success!*



**THIS WAY** The Chefette is the quickest, sturdiest, portable electric mixer—with three speed adjustment—for all mixing. Mashes potatoes too!



**THAT WAY** Stand the Chefette on its 'nose', click in the liquidiser...for mixing drinks, chopping raw vegetables, blending patés, making breadcrumbs, grinding coffee.



**PUT AWAY** Dual purpose wall bracket is a fixed cradle for using the liquidiser and keeps your Chefette safely out of the way when not in use.



# Kenwood kitchen!

For full information, and details of generous co-operative advertising terms, write to Dept 'C' 36.

KENWOOD MANUFACTURING  
(WOKING) LTD · OLD WOKING · SURREY

**now**  
*instant lettering*  
to solve your lettering problems



Instant Lettering is an incredibly simple method of lettering—anyone can do it. Self adhesive letters, printed on a special alphabet sheet, are just **rubbed down** into position on any art or drawing office material, metal, (machinery), plastic, wood, film, etc. The finished result is superb—no background film to letters, clean definition and opacity in black or white. Letter sizes range from this size type to type 14" high and there is a wide selection of type faces to choose from.

For free sample and details please pin this coupon to your own letterheading and post to

**LETRASET** DEPT. I.E.R.1  
Artist House • Plough Place  
London, E.C.4

## Cable Racks & Hangers



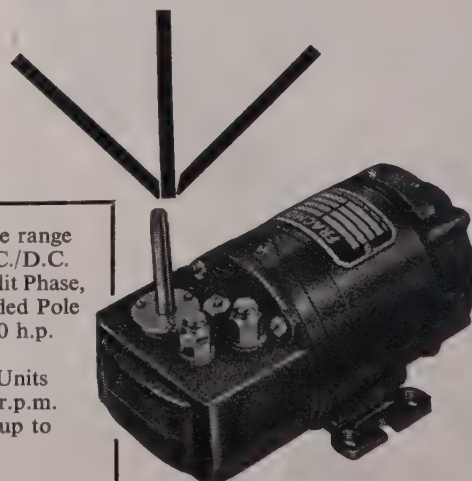
SEND FOR  
LIST OF  
STANDARDISED  
SIZES



E.D.L. INDUSTRIES LTD., Redbrook Lane, Brereton, Rugeley, Staffs  
Telephone: Rugeley 711

## FRACMO MOTORS

from 1/250th H.P.  
to 1/3rd H.P.



Our very wide range includes: A.C./D.C. Universal, Split Phase, 3-Phase, Shaded Pole Motors, 1/250 h.p. to 1/3rd h.p. also Geared Units 0.125 to 600 r.p.m. with Torque up to 850 lb/in.

Illus: Type 334C40 Geared Motor with A.C. and D.C. interchangeable frames. 1-20 r.p.m. Torque: 20-10 lb/in.

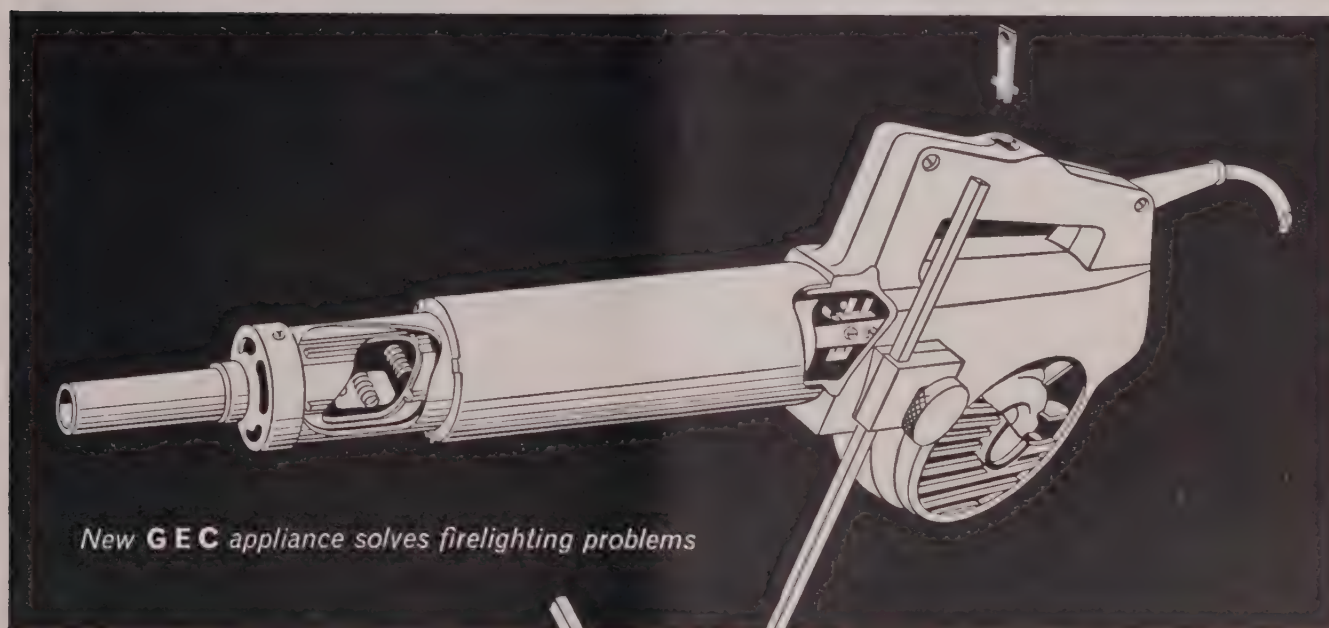
**FRACTIONAL H.P. MOTORS LIMITED**  
Rookery Way, London, N.W.9 Phone: COLindale 8022-3-4

Agents Law & Plumtree, Dale Buildings, Dale Road, Matlock, Derbyshire  
Telephone: Matlock 326

P. A. Bennett, 29 Hollins Drive, Sheffield, 6 Telephone: Sheffield 345967



# **FIRELIGHTING IS FASTER** **WITH HEATING ELEMENT SPIRALS OF** *Brightray*<sup>\*</sup>**C** **ALLOY**



Set it up, switch on, and in minutes the coal or coke in the grate is blazing away . . . GEC's new ELECTRIC FIRELIGHTER ignites solid fuel by *hot air*. Its heating element spirals of BRIGHTRAY 'C' long-life nickel-chromium alloy, raise the temperature of the fan-induced air to the point at which domestic solid fuels rapidly ignite. The 1800-watt BRIGHTRAY 'C' element can be switched off leaving the air jet to fan the flames. Running costs are low, fire-lighting easier, *and faster*.

Designers are invited to send for our publication giving useful data on the BRIGHTRAY Series of Electrical Resistance Materials.

\*TRADE MARK

To Henry Wiggin & Co Ltd, Wiggin Street, Birmingham 16.

Please send me a free copy of your publication  
 'Wiggin Electrical Resistance Materials'

NAME \_\_\_\_\_

POSITION OR DEPARTMENT \_\_\_\_\_

COMPANY AND ADDRESS \_\_\_\_\_

\_\_\_\_\_

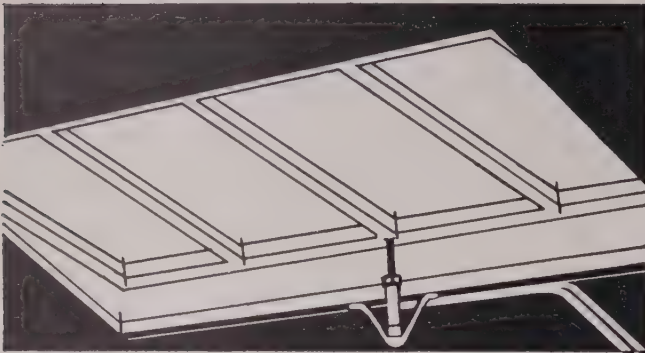
\_\_\_\_\_

ER/E16/9

**HENRY WIGGIN & CO LTD • WIGGIN STREET • BIRMINGHAM 16**



# remote control...



Ventilation can be improved by the operation of inaccessible windows and skylights with **ARMSTRONG HYDRAULIC CIRCUITS**.

No expensive and complicated linkages are called for. Maintenance is practically nil.

Many operations connected with valves and electrical equipment can be simplified giving saving in time and costs.

## easier and cheaper with



# ARMSTRONG



# HYDRAULIC CIRCUITS

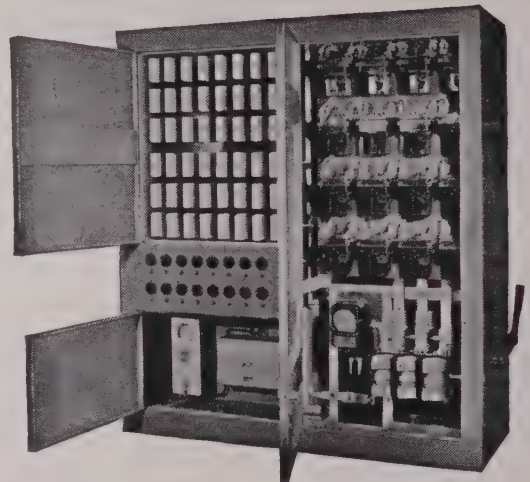
SEND FOR DETAILED LITERATURE

**ARMSTRONG PATENTS CO. LTD.**

Eastgate, Beverley, Yorkshire Tel: Beverley 82212

# BKS

## Heating Control Panels *built to individual Specifications*



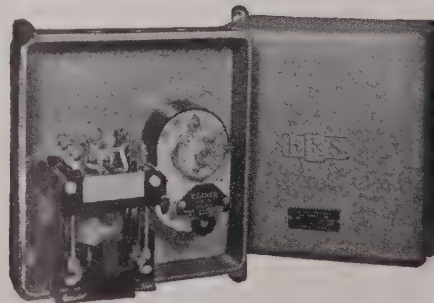
### THERMAL STORAGE HEATING

With the special off-peak tariffs now available through the electricity authorities, the overall cost of thermal storage space heating has been reduced to a most economical figure. We are specialists in the design and manufacture of automatic panels for space heating control and have supplied panels handling up to 500 kW.

The panel illustrated handles 267 kW. and is divided into 16 zones with individual limit thermostats and overall control by time switch; together with anticipatory control unit. We shall be most happy to quote for your automatic control panel.

### CONTACTORS

- Comprehensive range of contactors for all types of thermal storage and space heating control — 10 to 350 amp.
- SINGLE, DOUBLE, TRIPLE AND FOUR POLE.
- FOR SILENT OPERATION. All models can be fitted with D.C. operating coil and rectifier.



Triple pole 30 amp. Contactor with Time Switch type MD1.SP

### BRITISH KLOCKNER SWITCHGEAR LTD.

Head Office and Works: Chertsey, Surrey

Telephone: Chertsey 3467

Telegrams: Switchgear, Chertsey

Branches at Manchester, Glasgow, Newcastle, Midlands and Eire  
Agents throughout the world

ASSOCIATED COMPANY

Hindustan Klockner Switchgear Limited, Bombay

**post this coupon TODAY!**

To **BRITISH KLOCKNER SWITCHGEAR LTD., CHERTSEY, SURREY**

Please send me your list of Contactors for Heating Control

NAME \_\_\_\_\_

POSITION \_\_\_\_\_

FIRM \_\_\_\_\_

ADDRESS \_\_\_\_\_

HCPR



# Classified Advertisements

**CLASSIFIED** advertisements are PREPAID at 4/- per line (approx. 6 words).

**DISPLAYED CLASSIFIED**:—53/- per single column inch.

Where an advertisement includes a Box Number there is an additional charge of 1/-.

**SERIES DISCOUNTS** for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

**SITUATIONS WANTED**:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

Remittances payable to "ELECTRICAL REVIEW."

**REPLIES TO BOX NUMBERS** should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1. If an applicant for a situation appearing under a Box Number does not wish his reply to be forwarded to a particular firm or individual, instructions to this effect should be addressed to the Advertisement Supervisor, ELECTRICAL REVIEW. The name of an advertiser using a Box Number cannot be disclosed.

## OFFICIAL NOTICES, TENDERS, ETC.

### NEATH RURAL DISTRICT COUNCIL

Street Lighting Road B.4434: Tonna

**TENDERS** are invited for the supply and erection of 37 fifteen-ft. Concrete Columns and 37 60-watt Sodium Lamps, Lanterns, together with all auxiliary gear and wiring.

General conditions of contract, specification and bill of quantities may be obtained from, and plans inspected at, the department of the Engineer and Surveyor (Mr. J. T. Jones, F.R.I.C.S.), 18, Orchard Street, Neath, on payment of £2 2s., which will be refunded on receipt of a bona fide tender.

Tenders in plain sealed envelopes, endorsed "Street Lighting for Tonna Road," must be sent to the undersigned so as to reach him not later than Monday, 2nd October, 1961.

I. H. K. THORNE,  
Clerk of the Council.

Orchard Chambers,  
Orchard Street, Neath.

2211

### MIDLOTHIAN COUNTY COUNCIL

invite tenders for the supply and erection of 10 140-watt, 6 60-watt and 111 45-watt Sodium Discharge Lighting Units mounted on steel columns; for the conversion of 49 units to 60-watt or 45-watt Sodium Discharge, and for ancillary works at Polbeth and Limefield, West Calder, Midlothian.

Conditions of contract, specification, bill of quantities and form of tender may be obtained from and the plan inspected at the office of the County Surveyor, 32, Palmerston Place, Edinburgh, 12.

Sealed tenders endorsed "Street Lighting, Polbeth and Limefield, West Calder," should be lodged with the County Clerk, County Buildings, George IV Bridge, Edinburgh, 1, by 10 a.m. on Friday, 13th October, 1961.

The County Council do not bind themselves to accept the lowest or any tender.

2273

### FYLDE WATER BOARD

Contract No. 150

**Lime Dosing Pump and pH Control Equipment, Stocks Filters, Slaidburn**

**TENDERS** are invited for the supply and installation of Lime Dosing Pump, pH Control Equipment, Pipework and Electrical Wiring at Stocks Filter House, Slaidburn, Yorks (W.R.).

Further particulars and tender documents from the Engineer, Fylde Water Board, Sefton Street, Blackpool.

Tenders must be received not later than 13th October, 1961.

2286

### FYLDE WATER BOARD

Contract No. 149

**Electrical Installation, Wyre Lane Pump House, Garstang**

**TENDERS** are invited for the installation of Electrical Equipment to be supplied by the Board, and for the supply and installation of lighting and power supplies to the Pump House at Wyre Lane, Garstang.

Further particulars and tender documents from the Engineer, Fylde Water Board, Sefton Street, Blackpool.

Tenders must be received not later than 13th October, 1961.

2285

## SITUATIONS VACANT

(See "Replies to Box Numbers" above)

### Eastern Electricity

Essex Sub-Area  
197/61.R

**THIRD ASSISTANT ENGINEER**  
(Planning and Development),  
SUB-AREA HEADQUARTERS.

The work involves assistance in planning of schemes up to and including 33 kV. A good background of technical training in distribution together with technical qualifications and some knowledge of the preparation of switchgear specifications is desirable.

The position offers an excellent opportunity for obtaining experience over a wide field of planning work.

Salary N.J.B. Class M, Grade 10 (£1,325-£1,460) inclusive of London allowance.

Apply by letter to C. C. Brazier, A.M.I.E.E., Engineer, Essex Sub-Area, Eastern Electricity Board, Millfield, Bentley, Nr. Brentwood, Essex, by 29th September, 1961.

Northmet Sub-Area  
198/61.R

**GENERAL ASSISTANT ENGINEER**  
(Senior Draughtsman),  
CIVIL ENGINEERING AND  
BUILDING SECTION,  
SUB-AREA ENGINEER'S DEPT.  
(Reference 1083).

The successful candidate will be responsible for the preparation of drawings, for building and civil engineering work, for offices, show-rooms, workshops, 11 and 33-kV substations, etc., and should be capable of carrying out site surveys and supervising drawing office staff.

Possession of the Ordinary National Certificate (Building) or equivalent qualification will be an advantage.

Salary N.J.B. Class N, Grade 15 (£1,015-£1,140) inclusive of London allowance.

Apply by letter to the Manager, Eastern Electricity Board, Northmet Sub-Area, Northmet House, Southgate, London, N.14, by 29th September, 1961.

2313

Advertisements are accepted up to first post on Monday of the week of issue

If blocks, bold type or ruled borders are required then on Friday prior to week of issue

All communications to be addressed to:  
Classified Advertisement Department,  
ELECTRICAL REVIEW  
Dorset House, Stamford Street  
London, S.E.1

Original testimonials should not be sent with applications for employment

### CENTRAL ELECTRICITY GENERATING BOARD

North Eastern Region

Fourth Assistant Engineers (Substations)

**A**PPPLICATIONS are invited from engineers to supervise the work of contractors engaged on the installation of transformers, switchgear, cables and associated equipment at transmission substations. Previous experience of this work is desirable but not essential.

Varied and interesting developments are taking place in the Region on the introduction of the 400-kV system, which candidates will in time be expected to supervise.

Preference will be given to candidates who possess or are completing qualifications leading to Corporate Membership of the I.E.E.

The salary for the appointment will be in accordance with the National Joint Board Agreement, Grade 11, Class K (£900-£1,165 per annum).

Forms of application may be obtained from the Assistant Regional Secretary (Personnel), Central Electricity Generating Board, North Eastern Region, 1, Whitehall Road, Leeds, 1, to whom they should be returned to arrive not later than 29th September, 1961.

2276

### SERVICES CLERK OF WORKS FOR OXFORD UNIVERSITY

**A**PPPLICATIONS are invited for the position of a MECHANICAL AND ELECTRICAL SERVICES CLERK OF WORKS in connection with two new building projects.

The buildings, one of which is an Engineering Laboratory, the other a Biochemistry Laboratory, are under construction and will take approximately two years to complete, and will be provided with full range of mechanical and electrical services.

The successful applicant must have experience and knowledge of mechanical and electrical services in modern technical buildings and their relation to the structure and finishes of the buildings. He will be expected to co-ordinate on site under the direction of the Architects and Consulting Engineers, the various mechanical and electrical Sub-Contractors and organise the work to fit in with the Main Contractor's programme.

Salary scale £800/£1,100 according to qualifications and experience.

Applications should be made in writing, giving details of all experience and qualifications to Steensen, Varming & Mulcahy, Consulting Engineers, 146, New Cavendish Street, London, W.1.

2275



**Situations Vacant (continued)****NORTH WESTERN ELECTRICITY BOARD****Second Assistant Engineer, Planning and Design  
Section, Area Board Headquarters,  
Manchester**

Applicants must have had experience in distribution work up to and including 33 kV, and in particular on the design, layout and construction of 33-kV substations, including plant and ancillary equipment. The minimum technical qualification required is the Higher National Certificate or equivalent in Electrical Engineering.

Salary scale £1,415/£1,720 p.a., Grade K.5. N.J.B. conditions.

Applications on forms to be obtained from the Secretary, North Western Electricity Board, Cheetwood Road, Manchester, 8, and returned to him by 25th September, 1961.

**District Senior Clerk, Bury District**

The person appointed will be responsible for the supervision of all clerical functions in the District. Applicants should have had experience in secretarial practice, meter reading, costing, invoices, stores, salaries, wages and conditions of service, correspondence and general office routine, and in dealing with consumers' enquiries, records and accounts.

Salary scale £1,150/£1,240 p.a., Grade 6. N.J.C. conditions.

**Senior Assistant (Sales Superintendent),  
Bolton District**

Applicants should have a sound commercial background, including a thorough knowledge of up-to-date sales promotion methods.

The successful candidate must be capable of organising sales campaigns including direct mail, exhibitions, demonstrations, etc.

Duties will include the supervision of four service centres, demonstrators, sales representatives and the control of stock. Ability to develop business is essential and preference will be given to applicants with technical qualifications. The appointment will date from early December and following the retirement of the present holder of the post.

Salary scale £1,150/£1,240 p.a., Grade 6. N.J.C. conditions.

Applications on forms to be obtained from the Manager, No. 2 Sub-Area, North Western Electricity Board, 2, St. George's Road, Bolton, and returned to him by 25th September, 1961.

**Third Assistant District Engineer,  
Preston District**

Duties will include the operation, maintenance and construction of underground and overhead mains and substations, and general distribution work.

Preference will be given to applicants who hold the H.N.C. in Electrical Engineering.

Salary scale £1,040/£1,165 p.a., Grade H.9. N.J.B. conditions.

**Sub-Area Senior Demonstrator, Preston**

Applicants must have had a good education with training in domestic science, and should hold the E.A.W. Diploma. The person appointed will be required to give lectures and demonstrations on all types of domestic appliances, advise consumers on the choice of equipment, and must be capable of supervising staff and arranging the training and electrical education of new entrants up to E.A.W. Diploma standard.

Salary scale £780 × £25 to £880 p.a., Grade 3. N.J.C. conditions.

Applications on forms to be obtained from the Manager, No. 4 Sub-Area, North Western Electricity Board, 40/41, Lune Street, Preston, and returned to him by 25th September, 1961.

2297

**ELECTRICAL ENGINEERS****Graduate or Chartered Electrical Engineers Required**

aged not less than 30, for Industrial Group Consulting Service based in Birmingham.

Candidates should be well educated and have had three years' practical training with a large electrical manufacturer in workshops and drawing office.

Experience is desired in factory supply, distribution and utilisation, with ability to design schemes, specify and engineer electrical extensions and new factory installations. Supervision of contractors and negotiations with managements within the Group at Managing Director levels.

In particular, knowledge of variable speed drives, protection, heat treatment, automatic contactor control gear, H.V. and M.V. switchgear would be desirable advantages.

Initiative, drive and personality are as important as technical attributes, and opportunities to transfer within the Group may occur from time to time.

The Group provides for pension scheme, educational benefits, removal allowance, 3 months' subsistence allowance, car mileage allowance, annual pay reviews.

Applications will be treated in confidence and should be forwarded to:—

**The Chief Electrical Engineer**

**T. I. (GROUP SERVICES) LIMITED**

72, Cheston Road, Aston, Birmingham, 7  
and should be endorsed "ENGINEERS."

2231

**CITY OF LIVERPOOL  
EDUCATION COMMITTEE****North East Liverpool Technical College**

**A**PPPLICATIONS are invited for the appointment of PRINCIPAL of the above College. Salary £2,050 × £50 to £2,150.

The College, which is completely new, is scheduled to open in September, 1962. It will offer O.N.C. courses in Mechanical Engineering, Electrical Engineering, Building, Paint Technology and Rubber Technology. The average daily attendance is expected to be about 600 students.

Applicants should have a graduate qualification in engineering or science and should have held a position of responsibility in an establishment of Further Education. Duties will commence on 1st January, 1962, or as soon after that date as possible.

Further particulars and application forms (returnable by 11th October, 1961) from the Director of Education, 14, Sir Thomas Street, Liverpool, 1.

THOMAS ALKER,  
Town Clerk.

(J.6982)

218

**J. & P.****SENIOR SALES ENGINEER**

required in

Edinburgh and East of Scotland.

**J**OHNSON & PHILLIPS Ltd. have a vacancy at their Edinburgh branch for a SENIOR SALES ENGINEER to handle the sales of capacitors, switchgear and transformers. This is a permanent and responsible appointment with scope for advancement. A car will be provided.

Chartered Electrical Engineers or men with H.N.C. in Electrical Engineering are invited to apply, giving details of experience and training to:—

**The Employment Manager  
JOHNSON & PHILLIPS LTD.  
Charlton, London, S.E.7**

2314

**CENTRAL ELECTRICITY  
GENERATING BOARD****North Eastern Region****Third Assistant Engineer (Overhead Lines)**

**A**PPPLICATIONS are invited for the position of THIRD ASSISTANT ENGINEER (Overhead Lines) in the Transmission Project Branch of the Regional Electrical Department based on Leeds.

The successful applicant will be required to supervise the work of contractors engaged on the erection of main transmission overhead lines at 132-kV and 275-kV operation. Interesting work in the development of the 400-kV system is due to commence shortly.

Previous experience in all aspects of the setting out and erection of lattice steel tower lines is essential.

Preference will be given to candidates who possess or are completing qualifications leading to corporate membership of an appropriate professional engineering institution.

The salary for the appointment will be in accordance with the National Joint Board Agreement, Grade 8, Class K (£1,145-£1,410 per annum).

Forms of application may be obtained from the Assistant Regional Secretary (Personnel), Central Electricity Generating Board, North Eastern Region, 1, Whitehall Road, Leeds, 1, to whom they should be returned to arrive not later than 29th September, 1961.

2294

**MINISTRY OF AVIATION**

requires ELECTRICAL ENGINEERS (Assistant Signals Officers) for aviation telecommunications and electronic navigational aids. Min. age 23; 1st or 2nd Class Degree in Physics or Engineering, or A.M.I.E.E. or A.F.R.Ae.S. (candidates with Parts I, II & III of A.M.I.E.E. or Parts I & II of A.F.R.Ae.S. or equiv., or of very high professional attainment without those qualifications considered).

Salary £835 (age 23) to £1,318 (age 34), max. £1,490. Slightly lower outside Inner London. Prospects.

Forms from Ministry of Labour, Technical and Scientific Register (K), 28, King Street, London, S.W.1, quoting D.411/1A.

249



**SOUTHERN ELECTRICITY BOARD****Branch Commercial Superintendent**

Melksham District of No. 2 (Newbury) Sub-Area, located at Devizes. Salary N.J.B. Class G, Grade 8 (£1,040-£1,165 per annum). N.J.B. conditions of service.

Applicants should be qualified to accept responsibility within the branch for all commercial matters including development, installations and the application of tariffs.

Applications on forms obtainable from the Sub-Area Secretary, 7, Oxford Road, Newbury, Berks, and returned to him, quoting Z.1388, not later than 25th September, 1961.

**Assistant Engineer (Maintenance and Operation)**

Uxbridge District of No. 1 (Southall) Sub-Area. Salary N.J.B. Class G, Grade 9 (£965-£1,090 per annum, plus £50 per annum London allowance). N.J.B. conditions of service.

The duties of the post will be to assist with the maintenance and operation of switchgear, transformers, cables and overhead lines up to and including 11 kV. The appointment will involve standby duties.

Applications on forms obtainable from the Sub-Area Secretary, 2/6, Windmill Lane, Southall, Middlesex, and returned to him, quoting Z.1404, not later than 25th September, 1961.

**Installation Engineer**

Chichester District of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class F, Grade 8 (£965-£1,090 per annum). N.J.B. conditions of service.

Applicants should be qualified to organise and control all installation and maintenance work in the District and Branches and to collaborate with the Development Engineer and District Commercial Engineer in the preparation of contracting schemes of a large or exceptional nature.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him, quoting Z.1403, not later than 25th September, 1961.

The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible. 2323

**CENTRAL ELECTRICITY GENERATING BOARD****Midlands Region****West Midlands Division**

APPLICATIONS are invited for the appointment of POWER STATION SUPERINTENDENT, Drakelow A, B and C Power Stations, nr. Burton-on-Trent. Salary in accordance with the N.J.M. Agreement, Scale G.6, £3,270-£3,515 per annum.

Candidates must have considerable experience in the administration, operation and maintenance problems of a large modern power station.

Preference will be given to applicants holding a University Degree in Engineering or Corporate Members of the Institution of Electrical or Mechanical Engineers.

Applications should be made in writing, quoting Vacancy No. 242/61MD, to the Regional Personnel Officer, Regional Headquarters, 53, Wake Green Road, Birmingham, 13, by 29th September, 1961. 2326

**LONDON ELECTRICITY BOARD****Assistant Distribution Engineer**

APPLICATIONS are invited for the above position in the Board's Borough District, at 15, Penrose Street, London, S.E.17.

Applicants should have a sound technical education to the standard of the Higher National Certificate and possess practical experience in all branches of engineering work associated with the organisation of a District distribution department.

Housing accommodation could be made available to the successful applicant.

The post is graded under Schedule A of the National Joint Board Agreement as Class H, Grade 9, £1,090 per annum, rising to £1,215 per annum, inclusive of London allowance.

Applications stating age, qualifications and experience should be sent to the Manager at the above address within fourteen days of the publication date of this notice. Please quote ref. PER/V/3387/R. 2311

**'ENGLISH ELECTRIC'****POWER TRANSFORMER DESIGN**

English Electric, who design and manufacture a large range of Transformers up to 400 kV in the largest sizes, require Senior Designers.

Applicants should possess an Honours degree or A.M.I.E.E., coupled with several years' experience in the design of Power Transformers and/or components.

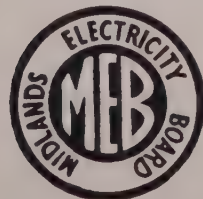
These are permanent and pensionable posts carrying attractive salaries for men with the right experience. Although initially the appointments will be in the U.K., opportunities may arise in the future to join our overseas manufacturing organisations.

Please write, giving details of qualifications and experience and quoting reference number ER 9902C to

**THE CHIEF ENGINEER, TRANSFORMER DIVISION**

c/o Dept. G.P.S., ENGLISH ELECTRIC HOUSE, STRAND, LONDON, W.C.2

2309

**MIDLANDS ELECTRICITY BOARD**

SECOND ASSISTANT DISTRICT ENGINEER required in the Dudley District of the South Staffs. and North Worcs. Area.

Applicants should have had experience in all branches of District work, including the installation, operation and maintenance of high and low-voltage cables, switchgear and transformers. Technical qualifications desirable.

Salary £1,190/£1,325 per annum (N.J.B. Grade H.7). Superannuable.

Apply by letter within 10 days stating age, qualifications, experience, present position and salary to Mr. D. Holt, Acting Area Manager (Ref. EMI/SEC), Midlands Electricity Board, P.O. Box No. 9, Toll End Road, Tipton, Staffs.

F. W. CATER,  
Secretary.

2300

**LONDON ELECTRICITY BOARD****Senior Draughtsman**

APPLICATIONS are invited for the above position in the Board's Southern District at 54, Bengeworth Road, London, S.E.5.

Applicants should have had a good general and technical education and possess the Ordinary National Certificate or its equivalent and be capable of supervising engineering draughtsmen and other drawing office staff. They should also have had experience in building construction, including reinforced concrete design, be able to prepare working drawings and structural calculations in connection with the conversion of existing premises into transformer chambers, together with the layout of electrical equipment and cabling.

The post is graded under Schedule A of the National Joint Board Agreement as Class J, Grade 10, £1,090 to £1,215 per annum, inclusive of London allowance.

Applications stating age, qualifications and experience should be sent direct to the Manager at 54, Bengeworth Road, London, S.E.5, within fourteen days of the publication date of this notice. Please quote ref. PER/V/3327/R. 2288

**MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD****No. 4 Sub-Area**

CONSUMERS' ENGINEER required in the Anglesey District, based on Holyhead.

Salary within the range £890/£1,015 per annum (N.J.B. E.8, Scale 6).

Applicants must have had a sound technical training, and experience within the industry in dealing with:—

- designing and estimating for all types of electrical installation work;
- advising consumers on tariffs, appliances and all aspects of electricity utilisation;
- organisation of service centres and exhibitions;
- control of manual and administrative staff.

Appointment subject to medical examination. Pension scheme.

Application forms obtainable from the Manager, No. 4 Sub-Area, Electricity House, Rhosyllen, near Wrexham.

Closing date 29th September, 1961. 2302



**Situations Vacant (continued)****SOUTH WALES ELECTRICITY BOARD**

**A**PPPLICATIONS are invited for the following positions:—

**Monmouthshire and Mid-Wales Area**

- (a) ASSISTANT COMMERCIAL ENGINEER, WEST MONMOUTHSHIRE DISTRICT (Bargoed)  
(Reference 76/61/ER) (Re-advertised).
- (b) GENERAL ASSISTANT ENGINEER, WEST MONMOUTHSHIRE DISTRICT (Ebbw Vale)  
(Reference 111/61/ER).

Preference will be given to engineers possessing the Higher National Certificate in Electrical Engineering.

Salary for both positions N.J.B. Class H, Grade 11, Scale 6, £890/£1,015 per annum.

Applications stating age, present position, present salary, qualifications, experience, and endorsing envelope with the appropriate reference, should be addressed to W. E. Richardson, M.I.E.E., Manager, Monmouthshire and Mid-Wales Area, Llywelyn Road, Cwmbran, to arrive not later than 30th September, 1961.

Previous applicants for the post of Assistant Commercial Engineer need not re-apply as their applications will be considered.

**Swansea and West Central Area**

- (c) FOURTH ASSISTANT ENGINEER (Substations), SWANSEA AND WEST CENTRAL AREA, at present located at Pontardulais (9 miles from Swansea)  
(Reference 112/61/ER).

The duties are of a general nature including mains and substations work. Preference will be given to engineers possessing the Higher National Certificate in Electrical Engineering.

Salary N.J.B. Class L, Grade 13, Scale 7, £965/£1,090 per annum.

Applications stating age, present position, present salary, qualifications, experience, and endorsing envelope with the appropriate reference, should be addressed to G. R. T. Edwards, B.Sc., M.I.E.E., M.Am.I.E.E., Manager, Swansea and West Central Area, 29, Ystrad Road, Fforestfach, Swansea, to arrive not later than 30th September, 1961.

R. G. WILLIAMS,  
Secretary.  
2320

## JUNIOR DESIGN ENGINEERS

are required by a well-known engineering organisation in the MANCHESTER AREA.

These vacancies are particularly suitable for young

**ELECTRICAL ENGINEERS**

who have completed an engineering apprenticeship and obtained technical qualifications to about H.N.C. level.

These posts offer the successful applicants the opportunity to obtain extensive design experience covering a wide range of products together with an insight into many production and commercial aspects of engineering.

If you are interested in these posts why not write to us today? Quote ref. JDE/ER.

Box 2292

# ELECTRICAL ENGINEER

A well known, progressive electrical engineering company in the Walsall area requires an experienced senior electrical designer.

Applicants must possess a wide range of practical experience, including redesigning and winding of all types of A.C. and D.C. machines, and be able to carry out design of special purpose electrical equipment. They should also be able to assume managerial responsibility within this progressive company.

There are excellent prospects; salary will be commensurate with experience and qualifications, but not less than £1,200 p.a.

Apply in writing, giving full details of qualifications and experience to Box Number 2274.

**CENTRAL ELECTRICITY  
GENERATING BOARD****North Eastern Region****Fourth Assistant Engineer  
(Programmes and Progress)**

**A**PPPLICATIONS are invited for the above position in the Transmission Project Branch of the Regional Electrical Department based on Leeds.

The successful applicant will be required to assist in the programming and progressing of transmission reinforcement schemes within the Region. The work is of an interesting and varied nature involving close contact with each successive stage from inception to final commissioning and including estimation of costs, incidence of expenditure and budget control.

The section is a new one and there is scope for the introduction of original ideas.

Candidates should possess or be completing qualifications leading to Corporate Membership of the I.E.E.

The salary for the appointment will be in accordance with the National Joint Board Agreement, Grade 9, Class K (£1,050-£1,325 per annum).

Forms of application may be obtained from the Assistant Regional Secretary (Personnel), Central Electricity Generating Board, North Eastern Region, 1, Whitehall Road, Leeds, 1, to whom they should be returned to arrive not later than 29th September, 1961.

2295

**ELECTRICAL AND MECHANICAL  
ENGINEER****Government of Aden  
Public Works Department**

**Q**UALIFICATIONS: Candidates must be Q.A.M.I.Mech.E. or A.M.I.E.E. with seven years' experience in general engineering works.

**DUTIES:** The maintenance of all mechanical and electrical plant in the Public Works Department. Erection and commissioning of new plant and equipment.

**TERMS OF APPOINTMENT:** Contract for 18-24 months.

**TOTAL EMOLUMENTS** (salary and gratuity) in scale £2,069-£2,710. Children's allowances. Free passages. Outfit allowance. Married quarters available at moderate rental.

Apply Director of Recruitment, Department of Technical Co-operation, Carlton House Terrace, London, S.W.1, giving full name, age and brief particulars of qualifications and experience, quoting RC.210/1/01/D.11.

2277

**SOUTH EASTERN ELECTRICITY BOARD**

**A**PPPLICATIONS are invited for the appointment of SUB-AREA ENGINEER in the Kent Sub-Area. The Sub-Area headquarters are at Rochester, Kent.

Salary £2,595-£2,815 per annum, in accordance with Grade 6, Class D of the N.J.M. and H.E. scales. Superannuable.

Corporate Membership of the I.E.E. is desirable and candidates must have had a wide experience of all aspects of electricity supply distribution as well as ability to control staff and organise work on a large scale. The Kent Sub-Area covers an area of 1,010 sq. miles and comprises several dense urban districts associated with large industrial supplies, and an extensive rural network.

Applications, quoting ER and naming two referees, to Kent Manager, 178, High Street, Rochester, Kent, by 27th September, 1961.

**METER TESTER,  
Mid-Sussex Headquarters.**

Wages 5s. 6½d. per hour for a 42-hour 5-day week under the N.J.I.C. Agreement.

Candidates should have served a recognised apprenticeship or a period of training and have had experience in the testing of single and polyphase A.C. meters, summation metering equipments and indicating and recording instruments. Location of appointment will be at the Mid-Sussex Central Meter Depot, North Road, Brighton.

Applications, quoting ER and naming two referees, to the Mid-Sussex Manager, Mid-Sussex House, North Road, Brighton, by 25th September, 1961.

GEORGE WRAY,  
Secretary.  
2328:

**CENTRAL ELECTRICITY  
GENERATING BOARD****West Midlands Division**

**A**SSISTANT SHIFT CHARGE ENGINEER is required at Neshells "A" and "B" Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade K.8, £1,275-£1,410 per annum, plus 10% for shift duties.

A sound technical training and practical experience in a power station are required. Appropriate technical qualifications desirable.

Apply, quoting Vacancy No. 240/61 MD, on form AE.6, available from the Station Superintendent, Neshells Power Station, off Aston Church Road, Neshells, Birmingham, 7, to whom they should be returned when completed not later than 25th September, 1961.

2296.



**CENTRAL ELECTRICITY  
GENERATING BOARD****Midlands Region****East Midlands Division****ASSISTANT PLANNING ENGINEER  
STAYTHORPE A and B POWER  
STATIONS**  
(Vacancy No. 210/61).

Applications are invited for the position of Assistant Planning Engineer at Staythorpe A and B power stations, near Newark, Notts.

Applicants should have held a position of responsibility in a modern power station and should have received a thorough practical and theoretical training. Preference will be given to candidates who are Corporate Members of a recognised professional institution or who hold qualifications leading to such membership.

Salary will be in accordance with Class H, Grade 8 (£1,440-£1,610 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 29th September, 1961.

**ASSISTANT INSTRUMENT ENGINEER  
STAYTHORPE A and B POWER  
STATIONS**  
(Vacancy No. 211/61).

Applications are invited for the position of Assistant Instrument Engineer at Staythorpe A and B power stations, near Newark, Notts. Applicants should have had sound training and wide experience in instrument making and/or repair. Preference will be given to candidates with knowledge of electronic and other modern forms of instrumentation and complex control systems as encountered in modern power stations or other large industrial organisations.

Salary will be in accordance with Class H, Grade 9 (£1,350-£1,500 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 29th September, 1961.

These appointments are pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Station Superintendent and should be returned to him by the date stated.

O. S. WOODS,  
Assistant Regional Director.

2324

**LONDON ELECTRICITY BOARD****Assistant Commercial Engineer**

APPLICATIONS are invited for the above position in the Commercial Department of the Board's West Bournie District, at 20, Victoria Gardens, London, W.11.

Applicants should possess a sound technical knowledge and be thoroughly conversant with modern practice in the installation, repair and maintenance of electrical equipment in buildings.

The successful candidate will be responsible for the supervision of personnel engaged on consumer service and contracting work on consumers' premises and will, in addition, be expected to prepare specifications, estimates and tenders for all classes of electrical installations.

The post is graded under Schedule A of the National Joint Board Agreement as Class J, Grade 8, £1,240 per annum, rising to £1,375 per annum, inclusive of London allowance.

Applications stating age and experience should be sent to the Manager, West Bournie District, 63/81, Pelham Street, London, S.W.7, within fourteen days of the publication date of this notice. Please quote ref. PER/V/3383/R.

2310

**LONDON ELECTRICITY BOARD****Assistant Commercial Engineer**

APPLICATIONS are invited for the above position in the Board's South Western District, at 204, Lavender Hill, London, S.W.11.

Applicants should possess a sound technical knowledge and be thoroughly experienced in all types of wiring installations and consumers' apparatus. Experience in voltage changeover work would be an advantage.

The successful candidate may be required to prepare specifications, estimates and tenders for all classes of electrical installations, to carry out negotiations in connection with voltage changeover, and to supervise specific projects as required.

The post is graded under Schedule A of the National Joint Board Agreement as Class K, Grade 10, £1,165 per annum, rising to £1,295 per annum, inclusive of London allowance.

Applications stating age and experience should be sent to the Manager at the above address within fourteen days of the publication date of this notice. Please quote ref. PER/V/3378/R.

2312

**CENTRAL ELECTRICITY  
GENERATING BOARD****require****ENGINEERS****FOR THE****STATION PLANNING SECTION**  
at Headquarters, London, S.E.1.

The section is responsible for the investigation and selection of sites for both conventional and nuclear power stations and for the negotiations for statutory and other consents.

A sound engineering background is essential, with qualifications equivalent to those required for Graduate Membership of the Institutions of Mechanical, Civil or Electrical Engineers. Experience of economic studies or one or more of the problems arising in the siting of power stations would be an advantage.

Salaries within the range £1,045 - £1,550 per annum.

Applications stating age, qualifications, experience, present position and salary to the Appointments Officer, 24/30, Holborn, London, E.C.1, by 4th October. Quote ref. ER/413.

2287

**RESIDENT SALES ENGINEER for IRAN**

OLD ESTABLISHED CONTINENTAL MANUFACTURERS OF ROTATING ELECTRICAL MACHINERY, REQUIRE SALES ENGINEER FOR TEHERAN OFFICE, FOLLOWING INSTRUCTION PERIOD AT WORKS.

LUCRATIVE POSITION WITH EXCELLENT PROSPECTS.

WRITE FOR PRELIMINARY INTERVIEW IN LONDON.

**Box 2198****MERSEYSIDE AND NORTH WALES  
ELECTRICITY BOARD****No. 4 Sub-Area**

ASSISTANT SECTION ENGINEER required at Aberystwyth in the Board's No. 4 Sub-Area.

Salary within the range £825/£940 per annum (N.J.B. E.9, Scale 5.)

Applicants should preferably have had experience in the construction, operation and maintenance of overhead and underground high and medium-voltage networks, with their associated substations and equipment.

Appointment subject to medical examination. Pension scheme.

Application forms obtainable from the Manager, No. 4 Sub-Area, Electricity House, Rhosyllen, near Wrexham.

Closing date 29th September, 1961.

2317

**TRANSFORMERS & RECTIFIERS LTD.****Millmead, Guildford****require a****SENIOR TRANSFORMER DESIGNER**

for work on all types up to 1,000 kVA. The company is expanding and the position carries excellent prospects for the right man. Some experience of saturable reactors an advantage.

Evening and Saturday morning interviews can be arranged and replies treated in strict confidence. Some housing assistance could be arranged if necessary.

2234

**AYRSHIRE EDUCATION AUTHORITY**

invite applications for the following posts in Ayr Technical College:—

**TEACHER OF ELECTRICAL ENGINEERING.** Applicants should hold an Ordinary Degree in Electrical Engineering or Associate Membership of the Institution of Electrical Engineers, or A.R.C.S.T. in Electrical Engineering. Teaching experience and/or practical experience in the electrical contracting industry would be an advantage. Salary on scales £785-£1,420 or £685-£1,290 according to qualifications, with an additional £65 per annum for approved teacher training.

**TEACHER OF ENGLISH AND SOCIAL STUDIES,** Chapter V or Article 39. Salary scale for Honours Graduate £960-£1,750 and for Ordinary Graduate £785-£1,420, with an additional £65 per annum for approved teacher training.

Forms of application are obtainable from the Director of Education, County Buildings, Ayr, to whom the completed forms should be returned not later than 23rd September, 1961.

2289

**YORKSHIRE ELECTRICITY BOARD****No. 3 (Sheffield) Sub-Area****SHEFFIELD CENTRAL DISTRICT  
SECOND ASSISTANT DISTRICT  
ENGINEER.**

Applicants should have had experience in the work of a District Engineering Department, including construction, operation, maintenance and planning.

Salary N.J.B. Class H, Grade 7 (Scale 10), £1,190/£1,325 per annum.

Applications together with the names of two referees should be sent to the Manager, Yorkshire Electricity Board, No. 3 (Sheffield) Sub-Area, Change Alley, Sheffield, not later than 29th September, 1961.

2322



**Situations Vacant (continued)****CENTRAL ELECTRICITY  
GENERATING BOARD****South Eastern Region**

**THIRD ASSISTANT ENGINEER,**  
ELECTRICAL DEPARTMENT,  
TRANSMISSION SECTION,  
GENERATION HOUSE  
(Vacancy No. 61/550).

Applications are invited for this superannuable post which is vacant in the North Section. Candidates should preferably be Corporate Members of the I.E.E. or hold equivalent qualifications, and should have had considerable experience in the operation and maintenance of high-voltage overhead lines and cables, switchgear (oil-filled and air-blast) and transformers. They must also have good knowledge of the Board's safety rules and experience in the control of both technical and manual staff and be familiar with the Board's negotiating machinery.

Salary N.J.B. Schedule A, Class K (Division), Grade 8 = £1,195-£1,460 per annum.

**FOURTH ASSISTANT ENGINEER**  
ELECTRICAL DEPARTMENT,  
TRANSMISSION SECTION,  
GENERATION HOUSE  
(Vacancy No. 61/551).

Applications are invited for the above superannuable post. Candidates should have a sound technical training, preferably with qualifications leading to Corporate Membership of the I.E.E., and experience in the maintenance of high-voltage switchgear, transformers, lines and cables. With the expected growth of the Grid System in the London Area these positions offer great opportunities for experience in transmission practice to the highest voltages.

Salary N.J.B. Schedule A, Class K (Division), Grade 11 = £950-£1,215 per annum.

Applications, quoting vacancy number, may be made to (or on form from) Personnel Department, Central Electricity Generating Board, P.O. Box No. 136, London, W.1. To be received not later than 26th September, 1961.

2293

**MERSEYSIDE AND NORTH WALES  
ELECTRICITY BOARD****No. 4 Sub-Area**

**SECTION ENGINEER** required at Aberystwyth in the Board's No. 4 Sub-Area.

Salary within the range £965/£1,090 per annum (N.J.B. E.7, Scale 7).

Applicants should have had experience in the construction, operation and maintenance of overhead and underground high and medium-voltage networks with their associated substations and equipment.

Appointment subject to medical examination. Pension scheme.

Application forms obtainable from the Manager, No. 4 Sub-Area, Electricity House, Rhosyllen, near Wrexham.

Closing date 29th September, 1961.

2301

**CENTRAL ELECTRICITY  
GENERATING BOARD****South Thames Division**

**Electrical Engineer's Department:**  
**Fourth Assistant Engineer (Technical), D.H.Q.**  
Amendment to Vacancy No. 236/61

**OWING** to reclassification the salary scales quoted should be amended to read as follows:—

London Area, £950 to £1,215 per annum.

Outside London Area, £900 to £1,165 per annum.

2331

**J. & P.****SALES  
ENGINEER**

required in London.

**JOHNSON & PHILLIPS Ltd.** have a vacancy at their London office for an engineer to handle the sales of switchgear, transformers, capacitors and cables. This is a permanent and responsible appointment with scope for advancement. A car will be provided.

Chartered Electrical Engineers or men with H.N.C. in Electrical Engineering are invited to apply, giving details of experience and training to:—

**The Employment Manager**  
**JOHNSON & PHILLIPS LTD.**  
Charlton, London, S.E.7

2315

**EAST MIDLANDS ELECTRICITY BOARD****Lincolnshire Sub-Area**

**APPLICATIONS** are invited from suitably qualified and experienced persons for the following appointment. Applicants should state age, qualifications, experience, etc., and quote the vacancy number.

**FIRST ASSISTANT DISTRICT  
COMMERCIAL ENGINEER,**  
LINCOLN DISTRICT  
(Vacancy No. 110/61).

Salary N.J.B. Class G, Grade 5, £1,275 to £1,410 per annum.

The duties will include assisting in the negotiations for the supply of electricity to consumers, advice on tariffs, electrical installations and appliances, sales activities, control of service centres and consumer service, and the preparation of specifications and estimates for electrical installations and the supervision of contracting work.

Ability to drive a motor vehicle is essential, and the person appointed will be required to live in or near Lincoln.

Applications should be forwarded to the Manager, Lincolnshire Sub-Area, North House, Grantham, Lincs., by the 29th September, 1961.

2327

**Due to expansion the**  
**CONTROL GEAR DIVISION**  
**of**

**G.W.B. FURNACES LTD.**

require additional

**ELECTRICAL ESTIMATORS**

at their Dudley Works. Applicants must be capable of analysing customers' requirements, preparing circuit diagrams and composite tenders. No electronics involved. Technical qualifications to H.N.C. standard preferred. Possibility of eventual promotion to outside sales staff for men of the right personality.

The works are situated in pleasant surroundings, and assistance with removal expenses will be given in approved cases.

Detailed applications, in confidence, which will be acknowledged, to Sales Manager, Control Gear Division, G.W.B. Furnaces Limited, P.O. Box No. 4, Dible Dale Works, Dudley, Worcs.

2202

**ELECTRICAL  
ENGINEERS**

required by the

**UNITED KINGDOM ATOMIC ENERGY  
AUTHORITY,  
DOUNREAY EXPERIMENTAL REACTOR  
ESTABLISHMENT, THURSO, CAITHNESS**

Vacancies exist for an **ELECTRICAL DISTRIBUTION ENGINEER** to be responsible for the control, operation and maintenance of 11-kV, 3.3-kV and 415-v. distribution and generation systems, and for an **ELECTRICAL MAINTENANCE ENGINEER** to be responsible for the maintenance and installation of electrical plant in process buildings.

Applicants must have served a recognised engineering apprenticeship and be Corporate Members of the Institution of Electrical Engineers or equivalent. For the post of Electrical Distribution Engineer, experience of permit-to-work systems, maintenance of switchgear and protective gear and control of turbo-alternator plant is essential. Experience of maintenance of motors and switchgear and of installation of plant is essential for the post of Electrical Maintenance Engineer.

Salary between £1,560 to £2,090 according to qualifications and experience.

Rented housing and house purchase assistance available for married officers living beyond daily travelling distance. Single accommodation available. Contributory superannuation.

Send POSTCARD for application form to the Personnel Manager at the above address, quoting reference 295/48.

2329

**SOUTH WESTERN ELECTRICITY BOARD**

**FOURTH ASSISTANT ENGINEER**  
(Drawing Office),  
**CHIEF ENGINEER'S DEPT.,**  
**HEAD OFFICE, BRISTOL.**

Salary within Class J, Grade 10, Salary Scale 8 (£970 to £1,165 per annum) of the N.J.B. Agreement.

The successful candidate will be responsible for the preparation of drawings and estimates of civil works in connection with indoor and outdoor H.V. substations.

He should have experience in the taking-off, abstracting and billing of quantities, have a working knowledge of reinforced concrete design and be fully conversant with up-to-date building construction. He will also be responsible for the training of apprentices as and when they become attached to the section.

Applicants should be in possession of the Higher National Certificate in Building Construction or qualifications leading thereto.

Applications for this post to be made on standard form AE6/ACT, OBTAINABLE BY POSTCARD ONLY from the Establishments Officer, South Western Electricity Board, Electricity House, Colston Avenue, Bristol, 1. Closing date for receipt of completed applications is 30th September, 1961.

2319

**MERSEYSIDE AND NORTH WALES  
ELECTRICITY BOARD**

**ASSISTANT SECTION ENGINEER** required at Rhyl/Rhuddlan in the Board's No. 4 Sub-Area.

Salary within range £890/£1,015 per annum (N.J.B. F/9, Scale 6).

Applicants should preferably have had experience in the construction, operation and maintenance of overhead and underground high and medium-voltage networks, with their associated substations and equipment.

Appointment subject to medical examination. Pension scheme.

Application forms obtainable from the Manager, No. 4 Sub-Area, Electricity House, Rhosyllen, near Wrexham. Closing date 29th September, 1961.

2316



CENTRAL ELECTRICITY  
GENERATING BOARD

## South Wales Division

APPLICATIONS are invited for the following superannuable N.J.B. Schedule A appointments:—

ASSISTANT MAINTENANCE  
ENGINEER (Electrical),  
TIR JOHN POWER STATION,  
SWANSEA, GLAM.  
(Vacancy No. 259/ER/61).

Salary Class H, Grade 9, Scale 8, £1,040 to £1,165 per annum.

Applicants should possess H.N.C. or equivalent qualifications and should have had wide experience in power station electrical maintenance.

STATION SHIFT CONTROL ENGINEER,  
LLANELLY POWER STATION,  
CARMS. (Vacancy No. 260/ER/61).

Salary Class E, Grade 10, Scale 4, £765 to £870 per annum plus £90 shift allowance.

Applicants should possess H.N.C. or equivalent qualifications and have had operating experience in a power station.

Special application forms obtainable from Divisional Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-Fedwen Road, Gabalfa, Cardiff, to be returned by 30th September, 1961.

2332

## YORKSHIRE ELECTRICITY BOARD

APPLICATIONS are invited for the post of SUB-AREA MANAGER in each of the following:—

No. 3 (Sheffield) Sub-Area  
(E.10 £3,765/£4,020 per annum)

No. 2 (Huddersfield) Sub-Area  
(C.10 £3,270/£3,515 per annum)

No. 7 (Grimsby) Sub-Area  
(B.10 £3,040/£3,270 per annum)

Applicants, who should have extensive knowledge of the industry and a wide experience in the organisation of large units of electricity supply, should state age and full details of qualifications and experience and should also indicate the appointment or appointments for which they wish to be considered.

Applications should be sent to the Secretary, Yorkshire Electricity Board, Wetherby Road, Scarcroft, Leeds, not later than Friday, 29th September, 1961.

2222

SOUTH OF SCOTLAND  
ELECTRICITY BOARD

## Stirling Area

APPLICATIONS are invited for the under-noted appointment:—

SECOND ASSISTANT COMMERCIAL  
ENGINEER (Ref. No. 52/61)  
for the Falkirk District of this Area.

Candidates should have had a sound practical training in electrical engineering and be experienced in the work of a commercial department of an electricity supply undertaking, especially in the use of electricity for space and water heating. The possession of a Higher National Certificate would be an advantage.

N.J.B. conditions. Salary Class G, Grade 7, £1,115/£1,245 per annum. Superannuable post.

Applications, on the standard form obtainable from the Area Manager, S.S.E.B., Woodlands, St. Ninians Road, Stirling, should be submitted not later than 29th September, 1961.

2330

MANAGER  
CAST EPOXY  
U.S.A.

PERMALI INC., U.S.A., a subsidiary of Permal Limited, Gloucester, is establishing a Cast Epoxy Department.

The Manager-designate will first spend some time in Gloucester and in Toronto (Canada). Permanent career visualised with initial two or three-year contract and opportunity of return to parent company.

Applicants should have experience of mould design and quantity production for heavy electrical industry.

Write with full details of education and experience to the Secretary, Permal Limited, Bristol Road, Gloucester.

2303

## ESTABLISHED MANUFACTURERS

of electrical domestic appliances require first-class SALES REPRESENTATIVES to introduce and develop sales of the STERLING AXIATHERM advertised in this issue, and to develop and expand existing connections in the following areas:—

- London North of the Thames, Middlesex and Essex.
- Oxfordshire, Buckinghamshire and Berkshire and Northamptonshire.
- Yorkshire.

It is desirable that applicants should reside on these territories and should at present be selling to the electrical and allied trades. Good salary, commission, contributory pension scheme with free life insurance. Car provided, expenses paid.

Full details, in confidence, of career over past 10 years, in chronological order, to the Secretary, STERLING ELECTRIC HOLDINGS LTD., Sterling Works, Dagenham, Essex.

2305

AIR MINISTRY  
(R.A.F. SIGNALS COMMAND):  
TECHNICAL CLASS

UP to 9 pensionable posts at Medmenham, Norton, Watton and St. Lawrence, Isle of Wight, for men at least 22 on 1.7.61.

Qualifications: O.N.C. in Electrical or Mechanical Engineering; or City and Guilds Intermediate Certificate in Telecommunications Engineering and City and Guilds Certificate in Radio II; or evidence of equivalent standard of technical education. Total of at least 8 years' comprehensive training and experience in skilled work on radio, radar or other electronic apparatus essential.

National starting salary £723 at 22 to £884 at 28 or over. Scale maximum £988. Promotion prospects.

Write Civil Service Commission, 17, North Audley Street, London, W.1, for application form, quoting S/5371/61. Closing date 20th October, 1961.

2304

ELECTRICAL MACHINE  
DESIGNER

required for manufacturers in S.W. Lancs. H.N. Certificate minimum. Should be familiar with detail design of all types of A.C. and D.C. machines and electro-magnetic equipment. Progressive post with contributory superannuation scheme after qualifying period.

State age, qualifications, previous experience and salary required. All applications in strict confidence.—Box C.211, Lee & Nightingale, Liverpool, 2.

159

SOUTH OF SCOTLAND  
ELECTRICITY BOARD

## Glasgow Area

APPLICATIONS are invited from suitably qualified engineers for the following superannuable appointment:—

ASSISTANT ENGINEER. Candidates should have experience in preparing specifications and estimates for power, heating and lighting installations.

Duties will include the charge of a small squad of maintenance electricians and mechanical fitters, and experience in the running of a small maintenance workshop is desirable.

Salary applicable to Third Assistant Engineer, viz., £1,190-£1,325 per annum in accordance with Class L, Grade 10 (Scale 10) of the N.J.B. Salary Scale.

The successful candidate shall be required to reside within reasonable travelling distance of Area Headquarters.

Applications, quoting reference No. GE/60/61, should be submitted on the standard application form which is obtainable from the Area Secretary, P.O. Box 6, 75, Waterloo Street, Glasgow, C.2, and should be returned not later than Monday, 25th September, 1961.

2318

CENTRAL ELECTRICITY  
GENERATING BOARD

## Southern Division, South Western Region

OVERHEAD LINE FOREMAN  
GRADE 1

## ALDERSHOT DISTRICT

APPLICATIONS should have extensive experience in the maintenance and construction of steel tower overhead lines operating at 132-kV and 275-kV, and have knowledge of the Central Electricity Generating Board transmission safety rules, governing work on high-voltage lines, together with previous experience in supervising field work. The successful applicant will be based at the District Office but will be required to work within the District boundaries.

Salary N.J.I.C. Grade 1, Schedule E, £880 per annum.

Applications giving details of education, training and experience should reach the District Engineer, Aldershot District, Lower Weybourne Lane, Farnham, Surrey, by Monday, 25th September, 1961.

2333

CENTRAL ELECTRICITY  
GENERATING BOARD

## West Midlands Division

APPLICATIONS are invited for the position of ASSISTANT ENGINEER (Operations) at Drakelow B Power Station. Salary will be in accordance with Class L, Grade 10, £1,190-£1,325 per annum, of the National Joint Board Agreement.

Applicants should possess a Higher National Certificate or equivalent qualifications and have had operation experience in a modern power station. Experience of pulverised fuel firing would be an advantage. The successful applicant will be required to act as relief for Assistant Shift Charge Engineers and will then be entitled to the appropriate grade and shift enhancement.

Apply, quoting vacancy number 243/61MD, on form AE6 available from the Station Superintendent, Drakelow Power Station, nr. Burton-on-Trent, Staffs. Closing date for receipt of applications 25th September, 1961.

2325



## Situations Vacant (continued)

CONSULTING  
ENGINEERS

have vacancies for

THERMAL GENERATION DESIGN  
AND CONTRACT ENGINEERS

**C**ORPORATE Members of one of the Senior Institutions preferred, but minimum qualification of H.N.C. associated with good practical experience will be considered. Salary in accordance with qualifications and experience. Bonus and pension schemes.

Applications, giving full details of age, qualifications and experience, to be made in writing within fourteen days to Preece, Cardew & Rider, 8-12, Queen Anne's Gate, Westminster, London, S.W.1.

2278

CENTRAL ELECTRICITY  
GENERATING BOARD

## Western Division

**S**ECOND ASSISTANT STATION  
CHEMIST (Vacancy Notice ER/AV/  
87/61) required in respect of the combined  
chemical services of PORTISHEAD "A" and  
"B" POWER STATIONS.

Superannuation scheme. Salary N.J.B.  
Class L, Grade 11, Scale 9, £1,115-£1,245  
per annum.

Candidates should possess H.N.C. (Chemistry)  
or equivalent qualification and should have had  
experience in the chemical control required on  
a large modern power station. A knowledge  
of the various mechanisms of corrosion and of  
oil firing and its associated problems would be  
an advantage.

Applications on form A.E.6/ACT, obtainable  
from the Divisional Secretary, 26, Oakfield  
Road, Bristol, 8, should be completed and re-  
turned by 25th September, 1961.

2321

WORKING ELECTRICAL FOREMAN  
REQUIRED

**O**NLY a man with drive need apply.  
Applicants willing to travel away  
from home. Wage will be £17 to £18  
per week with generous subsistence  
allowance and bonus scheme. State age  
and general experience.—Box 2215.

**A**PPLICATIONS are invited by Kennedy &  
Donkin, 12, Caxton Street, London, S.W.1  
(ref. RFL), for the post of assistant in the  
cable department at their Weybridge office.  
Applicants must be qualified electrical engineers  
with experience in design, manufacture and  
installation of cables for transmission and  
generation projects.

341

**C**ONSULTING engineer requires junior  
electrical engineer/draftsman to work  
on design of internal installation work on new  
industrial and commercial projects. Good salary  
paid in accordance with experience in this field.  
Write stating age, experience, technical back-  
ground and salary required to—G. H. Buckle  
& Partners, 2, Harrington Gardens, London,  
S.W.7.

2306

**C**ONTRACTORS, senior and assistant engi-  
neers required by well-established firm,  
central London, for quality work of all types.  
Positions offer scope for advancement for  
capable and energetic engineers. Write fullest  
detail, in confidence, of experience, training, age  
and salary required.—Box 133.

**D**RAUGHTSMEN. Section leaders required  
for cubicle and circuit design. Min.  
qualifications O.N.C. and 5 years' experience  
similar work. Higher than A.E.S.D. rates.  
Write to—Works Manager, Harmer & Simmons  
Ltd., Roebuck Road, Hainault, Essex.

2279

**E**AST Africa. Assistant engineer required;  
must be experienced in estimating and  
supervision for electrical contracts of all types  
and values. Write giving full details to—  
Box 2143.

**E**LECTRICAL draughtsmen, senior, inter-  
mediate, junior, required. Experienced in  
layout of industrial domestic electrical equip-  
ment. Salaries according to experience. Per-  
manency. Pension fund. Apply—C. W. Glover  
& Partners, Francis House, Francis Street,  
London, S.W.1.

2298

**E**LECTRICAL engineer, young, with interest  
in sales aspects, required for plant sales office  
of manufacturer of electric arc welding equip-  
ment. Apply (Ref. S), Murex Welding Processes  
Ltd., Hertford Rd., Waltham Cross, Herts. 2062

**E**LECTRICAL estimating engineer, age pre-  
ferred 25-30 yrs., experienced in preparation  
of lighting and power tenders with ability to  
accept responsibility of progressing work. Apply  
first in writing, stating education, experience,  
etc., to—Elequip Ltd., 106, London Road,  
Leicester.

2268

**E**LECTRICAL supervisor required for  
responsible position with a company  
engaged on nuclear power station construction.  
The successful applicant will assume control  
for electrical and associated work on the com-  
pany's sites. Write giving age, precise details  
of previous positions held, qualifications and  
required salary to—Box 2307.

**E**XPERIENCED servicing engineer required  
by a medium-sized engineering co. in N.W.  
London to service and maintain electric vehicles  
(including I.T.D. and conveyancer fork-lift  
trucks). Good wages. Canteen. Pension scheme.  
Apply to—Employment Officer, E.N.V. Engi-  
neering Co. Ltd., Hythe Road, Willesden,  
London, N.W.10.

2280

**F**ULLY experienced journeyman cable  
joiners required by large electrical com-  
pany. Applicants would be required to travel  
to any part of the country. London rates of  
pay and out allowance. Write stating age and  
giving brief details of experience to—Box 2244.

**J**OINTER (E.H.T.) required. Previous ex-  
perience essential. Present rate of pay  
5s. 6½d. per hour, N.J.I.C. conditions including  
42-hour 5-day week, holiday and sick pay  
schemes. Optional superannuation scheme.  
Apply by letter to District Manager, Midlands  
Electricity Board, 31, High Street, Stourbridge,  
Worcs.

2335

**J**UNIOR draughtsman or draughtswoman,  
preferably with experience of electrical in-  
stallations, required for electrical department  
of a large firm of building contractors and  
engineers situated in London, to prepare  
schemes and final drawings. Applications, with  
full details of experience and stating age and  
salary required, should be sent to—Box 2336.

**M**AN required to run small trading company  
supplying cable tray and trunking, lamps  
and small domestic appliances. Write stating age,  
experience and salary required to—Box 2338.

**M**ANUFACTURERS of cable trunking re-  
quire agents with well-established con-  
nections in Eastern, Southern and Western  
Counties. State in confidence details of lines  
already represented and areas worked.—Box  
2299.

**M**ECHANICAL fitter/assemblers required  
for assembly of medium and large size  
on-load tap changers for transformers. High  
piecework earnings possible. Apply personally  
or in writing to the Works Employment Officer,  
Fuller Electric Ltd., Fulbourne Road, Waltham-  
stow, London, E.17 (LAR. 2350).

2076

**M**EDWAY WATER BOARD requires a  
technical assistant (electrical) for duties  
in the Supply Department. O.N.C. in Electrical  
Engineering and drawing office experience essen-  
tial. Some knowledge of mechanical engineer-  
ing an advantage. Salary range £645 to £815  
p.a. Local government conditions of service  
and superannuation scheme apply. Write—  
Engineer and Manager, 25, Railway Street,  
Chatham, giving age and experience.

2308

**P**OLYPHASE test. Experienced testers or  
improvers. These vacancies afford unique  
opportunity for experience on calibration of a  
wide range of integrating electricity meters and  
ancillary equipment. Staff status after qualify-  
ing period. Please enquire—Personnel Manager,  
Landis & Gyr Ltd., Victoria Road, North Acton,  
London, W.3 (Acorn 5311).

2334

**T**ECHNICAL sales engineers required by  
expanding firm of electrical motor and gear-  
box manufacturers for East Midlands and for  
East Anglia.—Box 2128.

**V**ACANCY in sales office of well-known cable  
makers for live and energetic man. Good  
prospects. Write stating age, experience and  
salary required to—Box 2337.

**W**INDING shop foreman, age 35/40, for  
modern Midlands repair works. Attractive  
salary and conditions. Experienced in winding  
and coil making for large A.C./D.C. machines  
and H.V. transformers. Apply stating age,  
apprenticeship, training, present position, earn-  
ings and conditions.—Box 2129.

## APPOINTMENTS FILLED

Dissatisfaction having so often been expressed  
that unsuccessful applicants are left in ignorance  
of the fact that the position applied for has been  
filled, may we suggest that Advertisers notify  
us to that effect when they have arrived at a  
decision? We will then insert a notice free of  
charge under this heading.

## SITUATIONS WANTED

**A**.M.I.E.E. (47), medium/light engineering,  
seeks responsible post following merger  
and miscasting in reshuffle. Sales manager ten  
years. Sound record, able administrator, loyal,  
hard worker. Assured excellent references.  
Min. starting £1,500.—Box 8327.

**C**HARTERED electrical engineer, 10 years  
consulting at home and abroad, desires  
responsible position. Excellent references.—  
Box 8320.

**E**LECTRICAL engineer desires senior sales  
appointment. Considerable experience  
switchgear and motor controls. Competent  
negotiator. Widely connected.—Box 8330.

**E**LECTRICAL engineer with transformer  
design experience will consider change.  
Apply—Box 8325.

**S**COTLAND. Sales engineer, age 50, switch-  
gear, cable, accessories. Director level  
connections national industries, shipyards, in-  
dustrial users, wholesalers, contractors. Salary  
£1,250-£1,500.—Box 8333.

**S**WITCH and contactor gear representative  
requires change.—Box 8332.

## ARTICLES FOR SALE

## MOTORS

**N**EW CROMPTON PARKINSON,  
from ½ h.p. to 80 h.p.; also 6,000  
A.C. and D.C. reconditioned Motors  
and Starters.

IN STOCK HERE

B. E. WHITE

Brantwood Rd., Tottenham, London, N.17  
Tel. EDMonton 4621-2

215

## HOUSE SERVICE METERS

**200**—240-v. A.C. or D.C., 10 amps.  
capacity, quarterly type, from  
25s. each, plus 2s. 6d. carr.

UNIVERSAL ELECTRICAL CO.  
221, City Road, London, E.C.1

37

**A**.A. ELECTRICAL Co. for A.C.-D.C.  
motors, switchgear, exhaust fans, hoists,  
reduction gears, new or reconditioned units.—  
CHI.5105. 67, Rothschild Rd. London W.4. 57

**A**.C. and D.C. motors, generators, from  
stock.—Service Electric Co. Ltd., Honeyport  
Lane, Stanmore, Middx. (Edgware 5566/9). 91

**A**.C. and D.C. 1/- slotmeters. Guaranteed 2  
years, 2½-50 amps. From 55/-. Repairs  
and recalibrations. See Billiard: Tradex Meter  
Co., Surbiton (Tel. Elmbridge 2234/5/6). 169

**A**LTERNATORS, 3-phase, all sizes in stock  
from 7 kVA up to 600 kVA.—Britannia  
Manufacturing Co. Ltd., Britannia Walk,  
London, N.1 (CLBrkenwell 5512). 24

**A**LTERNATORS and generators, all types  
up to 150 kW.—Powerco Ltd., 312, York  
Road, London, S.W.18 (VAN. 5234). 151

**A**LTERNATORS for sale from 1,000 kVA at  
750 r.p.m. down to ½ kVA. Single and three-  
phase. All voltages. More than 150 machines  
in stock. Automatic regulators and switchboards  
available.—Fyfe, Wilson & Co. Ltd., Station  
Works, Bishop's Stortford. 162



**600****TOTALLY ENCLOSED AND FLAMEPROOF  
MOTORS 400/440/3/50**

H.P.	Maker	Speed	Type	Remarks
100	L.S.E.	980	Squirrel Cage	Flp. Grp. 1
90	M. & PLATT	980	Slip Ring	
75	E.E.C.	733	Slip Ring	
60	E.E.C.	980	Slip Ring	Flp. Grp. 2
54	L.S.E.	588	Slip Ring	
60	B.T.H.	1460	Squirrel Cage	
40	MET. VICK.	1460	Slip Ring	Auto Starter
40	BROOK	1460	Squirrel Cage	
37.5	L.S.E.	975	Slip Ring	
35	E.E.C.	1475	Slip Ring	

**GEORGE COHEN****SONS & CO. LTD.**Wood Lane, London, W.12 (Shepherds Bush 2070)  
Stanningley, Nr. Leeds (Pudsey 2241)

2281

**B**ARGAINS in electric motors from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Ring Monarch 3355. 50

**B**ILLIARD meters. 1/-, 6d. or 1d. slot. All time settings. From 170/-. See Quarterly.—Tradex, Surbiton. 170

**C**ABLE, armoured, P.I.L.C., P.V.C., R.I.L.C., V.C.I.L.C. All sizes in stock at our London works. Cutting and delivery same day as order received. Priced stock lists.—Batt Electrical Co., 6, Dock St., London, E.1 (Tel. Royal 5905). 316

**C**IRCUIT-breakers, various sizes in stock, A.C. and D.C., 200 amperes up to 2,000 amperes. Also dynamo and alternator switchboards.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 26

**C**ONVERTERS, motor-alternators, motor-generators, frequency changers, etc. All types up to 100 kW.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 150

**C**RANE motors. Direct current, series wound or compound wound, all voltages. We have large stocks.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 22

**D**IESEL generating sets, all sizes to 500 kW. Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 16

**E**LECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned, with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Clerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 20

**E**LECTRIC motors, generators, motor generator sets, transformers, switchgear, etc., large comprehensive stock, overhauled and guaranteed. Copy of our Register, "Electrical Surplus," containing thousands of items of electrical plant, sent on request.—R. F. Winder Ltd., Belgrave Electrical Works, Leeds, 2. 54

**F**LUORESCENT tubes reconditioned and guaranteed with a life as new for 78. 6d. each. Free collection and delivery in Lancs and Yorks. Save 40% on your tube replacement costs by using this service. We are also manufacturers of top quality fluorescent fittings, trunking systems, control gear and new fluorescent tubes. Generous discounts available.—Anglo-American Electrical Company, Clive Street, Bury (Telephone, Bolton 27251). 212

**F**OR sale, good unused and used machinery including electric motors, A.C. and D.C. dynamos, alternators, transformers, diesel and steam electric generating sets, mains failure sets, motor generator and Ward Leonard sets, switchgear, compressors, fans, capacitors, etc.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford, Herts (Tel. B.S. 1000/1). 161

**F**OR sale, one 7-panel D.C. vertical flat back type switchboard, suitable for use on a 220-volt, 2-wire system. Including 4 generator panels and 3 feeder panels with appropriate switches, circuit breakers and meters. For further details and permission to view apply to—The City Water Engineer, Denton House, Ilfley Turn, Oxford. 2237

**G**ENERATING sets, portable or stationary, new and reconditioned, 1 to 100 kW, A.C. and D.C.—Powerco Ltd., 312, York Road, London, S.W.18 (VAN. 5234). 148

**I**NSULATING varnish, clear, Minerva No. 720, £10 per 40-gal. drum.—Lowton Metals Ltd., Sandy Lane, Lowton St. Mary's, Leigh, Lancs. (Tel. 71441/2). 93

**L**IGHT fittings made to order—any design. Neon Construction Co. Ltd., 20, Calvin Street, London, E.1. 2230

**M**OTOR generator sets and converters, all sizes and voltages from 1/2 kW up to 500 kW in stock.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, City Road, London, N.1 (Tel. Clerkenwell 5512, 5513 & 5514). 12

**M**OTORS and control gear, huge stocks all types, 1/2 to 200 h.p.—Ramsbottom & Co. Ltd., Elec. Engineers, Keighley (5444/7). 70

**N**AMEPLATES, engraving, die-sinking, stencils.—Stilwell & Sons Ltd., 153, Far Gosford Street, Coventry. 108

**P**HASE converters, single to three-phase, several sizes in stock up to 90 h.p., 3-phase loading.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 29

**P**LATING dynamos and motor generator sets, various sizes from 500 amps. up to 2,000 amps., with A.C. and D.C. motors.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 15

**P**OLYPHASE kilowatt hour meters. Available from stock.—Universal Electrical, 221, City Road, London, E.C.1. 40

**P**REPAYMENT 1s. slot house service meters.—Universal Electrical, 217-221, City Road, London, E.C.1. 36

**P**URLEY chokes and ballasts. Our 80-w. tapped h.p.f. ballast with starter switch-holder incorporated is proving itself the most popular unit. Suitable for most fittings, 57s. 6d. each subject.—F. W. Blanshard Ltd. (Dept. ER), Purley, Surrey (Uplands 4818/9). 52

**Q**UARTERLY credit meters, single and poly-phase, 21/100 amps. From 20/-. Also D.C. See Television.—Tradex, Surbiton. 171

**R**OTARY converters in stock, all sizes; enquiries invited.—Universal Electrical, 221, City Road, London, E.C.1. 34

**S**MALL BR screws and nuts in steel, brass and stainless steel, from stock.—Premier Screw & Repetition Co. Ltd., Woodgate, Leicester. 180

**T**ELEVISION slotmeters and time switches. Details from: Tradex Meter Co., Surbiton (Elmbridge 2234/5/6). 172

**T**EN plating rectifiers by Davenset, 1,000 amps., 8 volts, oil immersed, with fine and coarse regulation. £350 ea.—Stewart Thomson Ltd., Seaford, Liverpool (Booth 2697/8). 2191

**V**ENNER time switches, 200-240 v. A.C./D.C., 10-50 amps., from stock.—Universal Electrical Co., 221, City Rd., London, E.C.1. 38

**W**ARD Leonard motor generating sets, all sizes.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1 (Tel. Clerkenwell 5512). 10

**2** B.T.H. 40-h.p., 1,475-r.p.m. electric motors for sale. Ball-bearing, continuously rated, with cabinet type control panel and ammeter, 400/440/3/50.—F. J. Edwards Limited, 359, Euston Road, London, N.W.1, or 41, Water Street, Birmingham, 3. 2282

**8** Ward Leonard motor generating sets.—O.B.M.T. Co. Ltd. (Rippleway 3715/3387). 2107

**334**-kVA Petter/Brush diesel alternator set, 400/440/3/50, four-wire, Petter SS4 600-r.p.m. switchboard and all accessories. New 1948. Little used and well maintained.—Joseph Pugsley & Sons Ltd., Bristol, 5 (Tel. Bristol 56037). 2131

**400**-cycle to 1,500-cycle motor alternators and alternators.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 27

**500**-kW, 220-volt Met.-Vick. rotary converter, with transformer, 11,000 volts, 3-phase, 50 cycles, and accessories.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 17

**SALES BY AUCTION**

By Order of the Receiver,  
E. C. Baillie, Esq., C.A.  
Re: the L.P.S. Electrical Co. Ltd.

PONSWOOD WORKS,  
THEAKLEN DRIVE,  
ST. LEONARDS-ON-SEA, SUSSEX

**HENRY BUTCHER & CO.**

are instructed to offer for  
SALE BY AUCTION, in LOTS, at  
THE QUEEN'S HOTEL, HASTINGS,

on  
WEDNESDAY, 11th OCTOBER, 1961  
and day following at Eleven a.m. each day,  
the

**PLANT, MACHINERY, STOCK  
& STORES****OFFICE FURNITURE & EQUIPMENT**

including Plastic Extruding Machines by "Andouart," "Iddon" and "Shaw"; High-speed Tubular Stranding Machines; Bunching, Lapping & Winding Machines; Heavy Laying-up Machines; Pneumatic Injection Moulders; Complete Plant for the manufacture of Tinsel Conductors; Winding, Coiling and Reeling Machines; Fine Wire Binding Machines; Motorised Braiding Machines; Injection Moulders; Telephone Cord Plaiting and Binding Machines; Wrapping Machines; Tagging Presses; Steel Bins and Racks; Reels and Drums; Lacquering Machines; Fine Wire Welders; S.S. and S.C. and Capstan Lathes; Drilling, Grinding, Milling and Shaping Machines; Air Compressors; Electric Motors; Engineers' Stores; Pumps; Electric Hoists; Electrical Test Equipment; Stock of Finished and Partly Completed Electric Cable, Copper Wire, Textiles and Stores; Office Furniture and Machinery, incl. "Adrema," "Comptometer," "Frieden," "Facit," "Gestetner," "Simplex," "Eliot Fisher" and "Remington" Machines.

Catalogues (when ready) may be obtained of:—

Messrs. LAYTON-BENNETT, BIL-LINGHAM & CO., Chartered Accountants, 23, Blomfield Street, London Wall, London, E.C.2; and of

Messrs. HENRY BUTCHER & CO., Auctioneers, Valuers & Surveyors of Factories, Plant & Equipment, 73, Chancery Lane, London, W.C.2.

Telephone: HOLborn 8411 (eight lines)

2283

**EQUIPMENT FOR HIRE**

**G**ENERATING set hire service. Consult the most experienced firm for A.C. and D.C. units from 2 kW to 240 kW, diesel or petrol, stationary or mobile, sale or hire, 24-hr. breakdown service.—Dawson-Keith Ltd., Hillview Rd., Sutton, Surrey (Fairlands 4401). 46

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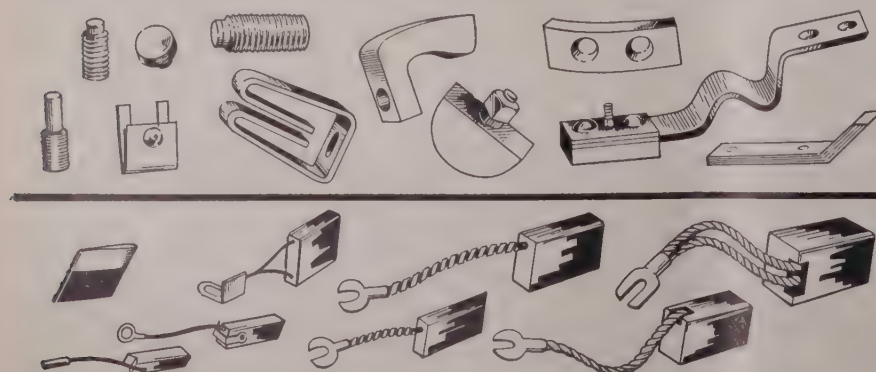
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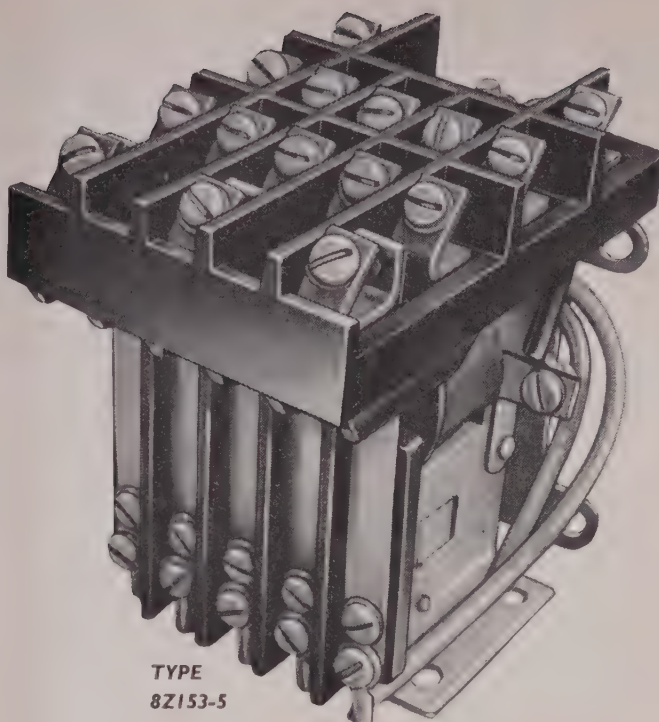


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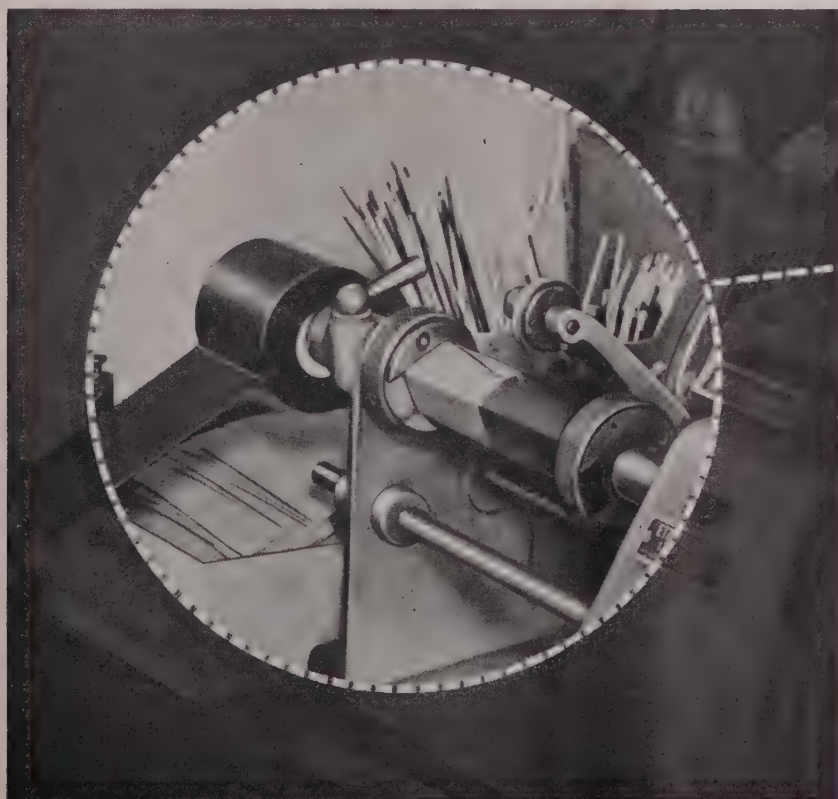
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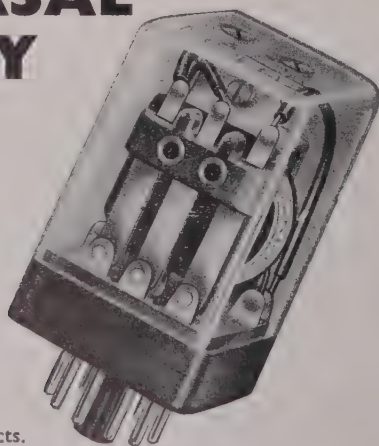
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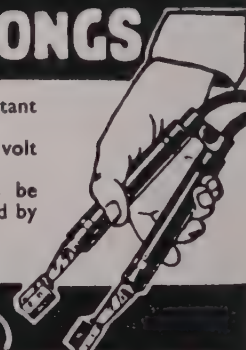
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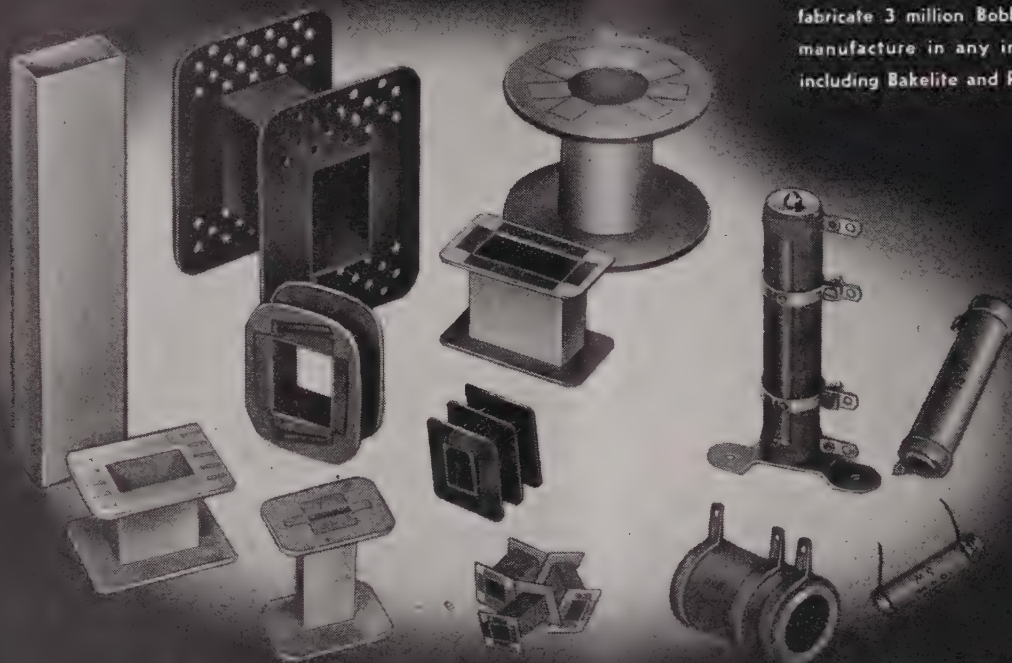
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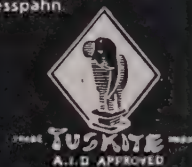
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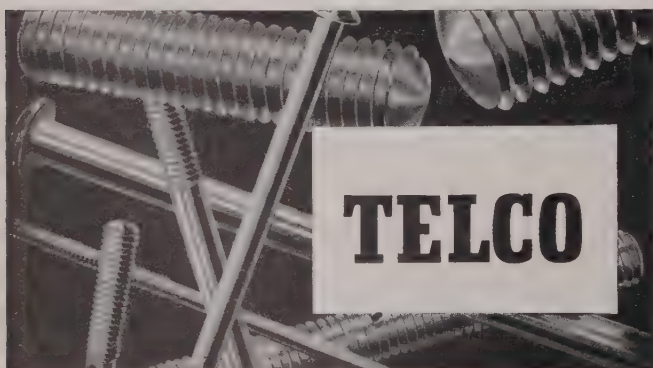
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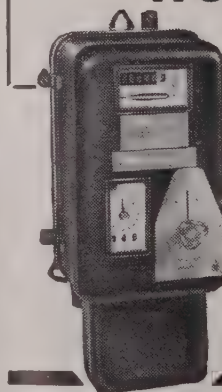
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15  
SEPTEMBER  
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# ELECTRIC BLANKETS

Sales of electric blankets have risen at a phenomenal rate in the past ten years. Recent figures issued by the British Electrical & Allied Manufacturers' Association indicate that manufacturers' deliveries to the home market in 1960 were 1,391,000, whereas in 1950 the corresponding figure was only 86,000. Sales for the first six months of this year were just a little down compared with the similar period of 1960, but it should be borne in mind that the winter was less severe than in previous years. Also, deliveries are in the main concentrated in the two remaining quarters of the year and there is hardly any doubt that sales for 1961 will reach the 1½ million mark.

There are now well over 200 different electric blankets, made by approximately 50 firms, from which a potential customer may make a choice. They range in size from the small standard single-bed model to the large "luxury" double-bed blankets which incorporate such refinements as temperature regulators, pilot lights, dual control switches, washable covers, etc. Of the three main types, possibly the most common in use is the non-thermostatic, mains voltage, low wattage blanket. There are also low voltage

models (usually 24 V or less), again low wattage types, which operate similarly, but through a transformer. The fast heating, mains voltage, high wattage blankets reach their maximum temperature more quickly and are controlled by thermostats within the blanket itself. To these may be added the signal-wire type blanket (Monogram Electric) which can be left on all night and adjusts itself automatically to changes in bedroom temperature.

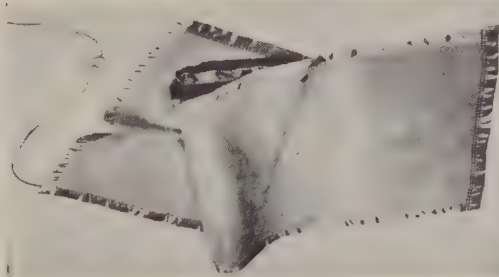
There are few manufacturers that do not now mark their products with the "Kite Mark" symbol. The presence of this symbol on an electric blanket is an indication that the British Standards Institution has satisfied itself that production is fully in accordance with the requirements of B.S. 2612, and all blankets complying with the Standard may carry the "Kite Mark."

The prices of electric blankets range from approximately £3 10s for the single-bed size to upwards of £15 for the double-bed "luxury" models. There has been a slight price increase because of the recent 10 per cent surcharge on the purchase tax rate but, generally speaking, the list prices have not changed during the past twelve months.

Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
H. J. BALDWIN & CO., LTD., 132, Arkwright Street, Nottingham.	"Thermat Regal"	60 × 30 (a) 60 × 48 (b)	85 W (a) 135 W (b)	Non-thermostatic	Pink	Wool mixture	Made to B.S.S.2612, neon switches	£4 4 0 (a) £6 6 0 (b)	£0 16 9 (a) £1 5 0 (b)
	"Thermat Lylux" P.2	54 × 24	64 W	Non-thermostatic	Pink	Raised cotton	Made to B.S.S.2612, neon switch	£3 5 0	£0 12 11
	"Thermat Lylux" D.2	54 × 42	105 W	Non-thermostatic	Pink	Raised cotton	Made to B.S.S.2612, neon switch	£4 15 0	£0 19 0
BERRY'S ELECTRIC MAGICOAL, LTD., Touchbutton House, Newman Street, London, W.1.	"Magicwarm" single	60 × 30	85 W	D/P neon illuminated switch	Blue or pink	Fireproofed wool mixture	Made to B.S.S.2612	£4 5 5	£0 17 1
	"Magicwarm" double	60 × 48	135 W	D/P neon illuminated switch	Blue or pink	Fireproofed wool mixture	Made to B.S.S.2612	£6 7 3	£1 5 7
BLANELLA, LTD., Thorp Arch Mill, Boston Spa, Yorks.	"Cozee Cumfette" S.U.J.	24 × 48	50 W	Single-heat neon switch	Pink or blue	Flameproofed wool mixture	Jointless element. Made to B.S.S.2612	£2 6 5	£0 9 4
	"Cozee Cumfort" S.U. (a) and S.U.V. (b)	24 × 54	58 W	Single-heat (a) Variable-heat (b) neon switches	Pink or blue	Flameproofed wool mixture	Jointless element. Made to B.S.S.2612	£2 12 10 (a) £3 15 11 (b)	£0 10 8 (a) £0 15 4 (b)
	"Cozee Cumfort" D.U. (a) and D.U.V. (b)	44 × 54	114 W	Single-heat (a) Variable-heat (b) neon switches	Pink or blue	Flameproofed wool mixture	Jointless element. Made to B.S.S.2612	£3 19 11 (a) £5 4 0 (b)	£0 16 1 (a) £1 1 0 (b)
	"Cozee Cumfort" D.D.U.	44 × 54	58 W + 58 W	Single-heat, dual-control neon switches	Pink or blue	Flameproofed wool mixture	Jointless element. Made to B.S.S.2612	£4 9 11	£0 18 1



1. Blanella "Cozee Cumfort" blanket  
2. H. J. Baldwin & Co.'s "Thermat Regal" blanket



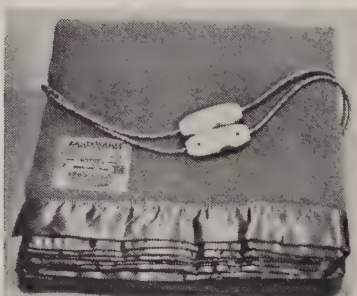


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4

3. Denham's "Norvic" low-voltage blanket with transformer
4. Berry's Electric "Magicwarm" blanket
5. Chas. Early & Co.'s "Earlywarm" blanket
6. Bulpitt "Swan Brand" blanket



5



6

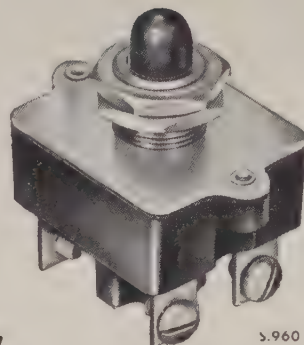
Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
S. N. BRIDGES & CO., LTD., York Road, Battersea, London, S.W.11.	"Luxury Life" single	60 x 30	92 W	Neon single-heat switch	Pink	Fleecy wool mixture	Made to B.S.S.2612	£4 11 2	£0 18 4
	"Luxury Life" double	60 x 50	120 W	Neon single-heat switch	Pink	Fleecy wool mixture	Made to B.S.S.2612	£6 12 10	£1 6 8
	"Luxury Life" double	60 x 50	95 W	Two-heat dual switches	Pink	Fleecy wool mixture	Made to B.S.S.2612	£9 2 9	£1 16 9
	"Royal Rest" double								
BULPITT & SONS, LTD., St. George's Works, 132, Icknield Street, Birmingham, 18.	"Swan" 712A	60 x 30	90 W	Thermal balance	Pink, peach or pastel blue	Raised cotton	Made to B.S.S.2612	£3 19 6	£0 16 0
	"Swan" 714A	60 x 50	135 W	Thermal balance	Pink, peach or pastel blue	Raised cotton	Made to B.S.S.2612	£5 15 0	£1 3 0
	"Cygnet" 5424	54 x 24	64 W	Thermal balance	Pink or blue	Raised cotton	Made to B.S.S.2612	£2 17 6	£0 11 6
	"Cygnet" 5442	54 x 42	105 W	Thermal balance	Pink or blue	Raised cotton	Made to B.S.S.2612	£4 2 10	£0 16 8
CREATORS, LTD., Albert Drive, Sheerwater, Surrey,	"Plansel"	48 x 24	60 W	Non-thermostatic	Pink or blue	Blanket cloth	2-year guarantee	£2 8 7	£0 9 10
DENHAMS (NORWICH), LTD., All Saints Road, Acton, London, W.3. (continued on page 6)	"Norvic" W3	26 x 60	67 W	Three-heat, self-compensating	Pink or blue	Fireproofed mixture, cloth bound, satin ribbon	Made to B.S.S.2612	£3 7 3	£0 13 6
	"Norvic" DW3	44 x 60	112 W	Three-heat, self-compensating	Pink or blue	Fireproofed mixture, cloth bound, satin ribbon	Made to B.S.S.2612	£5 1 0	£1 0 4
	"Norvic" C3	30 x 54	72 W	Three-heat, self-compensating	Pink or blue	Fireproofed cotton grid	Detachable washable fleecy cover, to B.S.S.2612	£4 3 3	£0 16 8
	"Norvic" CD3	46 x 60	122 W	Three-heat, self-compensating	Pink or blue	Fireproofed cotton grid	Detachable washable fleecy cover, to B.S.S.2612	£6 12 9	£1 6 8
	"Norvic" T3	32 x 60	84 W	Three-heat, self-compensating	Pink or blue	Fireproofed cotton grid, permanent flannelette cover	Detachable art silk cover, to B.S.S.2612	£6 8 9	£1 6 1



# Arcoelectric

## Switches

## Neon Signal Lamps



S.960

### S.L.160, S.L.162 and S.L.163

New miniature low cost Neon Signal lamps.  
 $\frac{1}{8}$ " hole fixing. All completely waterproof.  
 The S.L.163 has small front of panel projection.

C.S.200: 15-AMP Rotary Cooker Switch.  
 Double Pole three "heat" and "off".

S.L.50: Neon Signal Lamp with snap-in fixing.

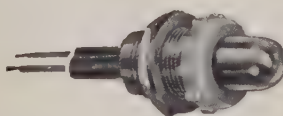
M.30: 10-AMP Toggle Switch.

S.L.190: New Snap-in fixing Neon Signal Lamp

S.254: AC only 10-AMP Toggle Switch, double pole.

S.250: A single pole version of the S.254.

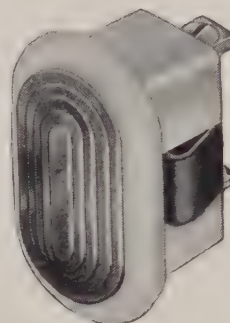
S.960: New Spin Drier Switch, double pole.



S.L.160



S.L.162



S.L.50

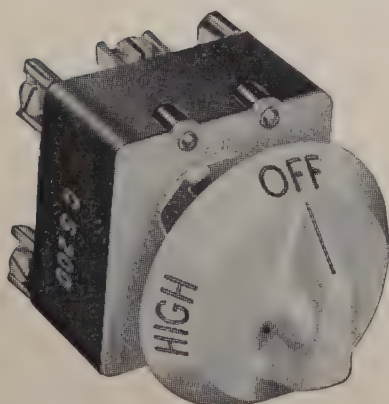


S.L.190

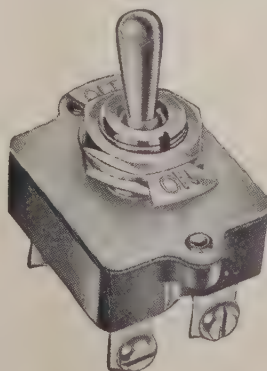
*Write for Catalogue No. 132*

## Arcoelectric Switches Ltd.

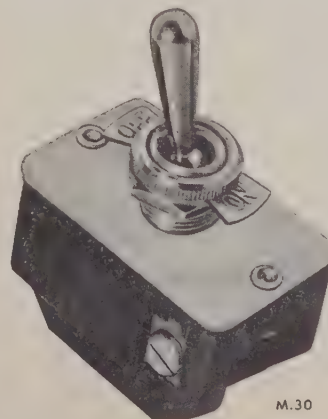
Central Avenue - West Molesey - Surrey - Tel: Molesey 3232



C.S.200



S.254



M.30

Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
<b>DENHAM'S (NORWICH), LTD.,</b> All Saints Road, Acton, London, W.3. (continued)	"Norvic" DR3	50 × 60	128 W	Three-heat, self-compensating	Pink or blue	Fireproofed cotton grid, permanent flannellette cover	Dual control. To B.S.S.2612	£10 13 0	£2 2 11
	"Norvic" 12 V all-night L.3	30 × 60	84 W	Three-heat through transformer	Pink or blue	Fireproofed cotton grid in fleecy mixture cloth	Price includes transformer	£9 15 2	£0 16 4
	"Norvic" 12 V all-night D.L.3	50 × 60	128 W	Three-heat through transformer	Pink or blue	Fireproofed cotton grid in fleecy mixture cloth	Price includes transformer. Dual control	£15 5 7	£1 6 10
	"Norvic" P.3	12 × 18	65 W	Three-heat switch, thermostat	Pink or blue	Fireproofed heavy felt base. Permanent cover	Detachable art silk cover	£3 11 0	£0 14 3
	"Panda" P.1	28 × 52	63 W	Single-heat, self-compensating	Pink or blue	Fireproof mixture cloth with satin ribbon	Made to B.S.S.2612	£3 3 4	£0 12 10
	"Panda" P.2	44 × 52	98 W	single-heat, self-compensating	Pink or blue	Fireproof mixture cloth with satin ribbon	Made to B.S.S.2612	£4 4 0	£0 17 1
<b>CHARLES EARLY &amp; MARRIOTT (WITNEY), LTD.,</b> Witney Mills, Oxfordshire.	"Earlywarm" single	60 × 80 (heated area 32 × 58)	80 W	Ten-position switch	Rose, blue, green or gold	Mothproofed wool	To B.S.S.2612, two-year guarantee, zip storage bag	£8 2 2	£1 9 4
	"Earlywarm" double	80 × 80 (heated area 51 × 58)	130 W	Two ten-position switches	Rose, blue, green or gold	Mothproofed wool	To B.S.S.2612, two-year guarantee, zip storage bag	£11 14 4	£2 2 5
	"Witney Comfort" single	30 × 60	80 W	Three-heat neon switch, non-thermostatic	Rose	Mothproofed wool, satin binding	To B.S.S.2612, two-year guarantee	£4 17 3	£0 19 6
	"Witney Comfort" double	48 × 60	136 W	Three-heat neon switch, non-thermostatic	Rose	Mothproofed wool, satin binding	To B.S.S.2612, two-year guarantee	£6 11 1	£1 6 5
<b>EASIPOWER APPLIANCES, LTD.,</b> 30, High Street, Southampton.	"Dreamland" neon single Type NS	60 × 30	80 W	Non-thermostatic	Peach	Rayon/cotton mixture	Illuminated switch. To B.S.S.2612	£4 4 9	£0 16 2
	"Dreamland" neon double Type ND	60 × 48	130 W	Non-thermostatic	Peach	Rayon/cotton mixture	Illuminated switch. To B.S.S.2612	£6 5 3	£1 3 11
	"Dreamland" single Type 3 HS	60 × 30	80 W	Three-heat	Peach	Rayon/cotton mixture	Satin bound. To B.S.S.2612	£5 9 2	£1 0 10
	"Dreamland" double Type 3 HD	60 × 48	130 W	Three-heat	Peach	Rayon/cotton mixture	Satin bound. To B.S.S.2612	£7 18 8	£1 10 4
	"Dreamland" luxury single Type 3FS	60 × 30	80 W	Three-heat	Pink one side, blue the other	Rayon/cotton mixture	"Safety-seal" construction. To B.S.S.2612	£5 12 6	£1 1 6
	"Dreamland" luxury double Type 3FD	60 × 48	140 W	Three-heat	Pink one side, blue the other	Rayon/cotton mixture	"Safety-seal" construction. To B.S.S.2612	£8 2 10	£1 11 2
<b>EKCO HEATING &amp; ELECTRICAL, LTD.,</b> 41/47, Old Street, London, E.C.1. (continued on page 8)	"Juno"	50 × 28	34 W	Normal heat dissipation	Peach	Soft fleecy blanketing	To B.S.S.2612, D/P neon switch	£2 17 6	£0 11 6
	" Sylvia "	60 × 32	82 W	Normal heat dissipation	Peach	Soft fleecy blanketing	To B.S.S.2612, D/P neon switch	£3 15 0	£0 14 11
	"Sherborne"	60 × 32	82 W	Normal heat dissipation	Blue or rose	Luxurious "Dormy" blanketing	To B.S.S.2612, D/P neon switch	£4 15 0	£0 18 11
	"Sherborne" with "Ekcostat"	60 × 32	82 W	Automatic control	Blue or rose	Luxurious "Dormy" blanketing	"Ekcostat" control	£6 2 0	£1 4 4
	"Dorchester"	60 × 52	138 W	Normal heat dissipation	Blue or rose	Luxurious "Dormy" blanketing	To B.S.S.2612, D/P neon switch	£6 12 6	£1 6 4
	"Dorchester" with "Ekcostat"	60 × 52	138 W	Automatic control	Blue or rose	Luxurious "Dormy" blanketing	"Ekcostat" control	£7 19 6	£1 11 8
	"Dorchester Twin"	60 × 52	138 W	Dual automatic controls	Blue or rose	Luxurious "Dormy" blanketing	To B.S.S.2612, two "Ekcostat" controls	£11 13 11	£2 6 6





Now incorporates "Safety-Seal" construction  
**GRANTED THE ELECTRICAL ENGINEERS HIGHEST AWARD AS  
 THE OUTSTANDING TECHNICAL DEVELOPMENT OF THE YEAR**

Dreamland Electric Blankets are the first to incorporate the revolutionary new process "SAFETY-SEAL" Construction, designed and patented throughout the world by Dreamland. This new electric blanket manufacturing technique, incorporated in the Dreamland 3-heat Luxury Model, was awarded the Silver Plaque at the A.S.E.E. Exhibition at Earls Court for the year's most outstanding development in the Domestic Appliance field. By this process the heating element is sealed in a special foam material and the entire blanket is welded into one inseparable unit for maximum safety and comfort.

arable unit for maximum safety and comfort.

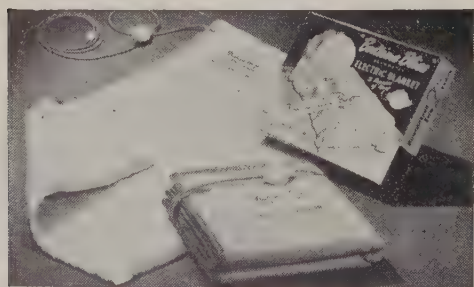
The Dreamland 3-heat model with new "Safety-Seal" construction is also the first All-British Electric blanket to be made in two colours — Sky Blue one side, Coral Pink the other. It is edged with a silver grey satin binding and has special means for securing the blanket to the mattress. With a new style 5-position illuminated switch it sells at £6.14.0, Single size; £9.14.0. Double. The complete Dreamland range also includes Single and Double bed size; single heat, Standard models priced from £5.0.11.



*A full-scale advertising campaign will be supporting Dreamland stockists this autumn and winter and every Dreamland retailer gets an extra 5% discount. It could be a dream of a year for you!*

**EASIPower APPLIANCES LTD.** 30, High Street, Southampton

Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
<b>EKCO HEATING &amp; ELECTRICAL, LTD.,</b> 41/47, Old Street, London, E.C.1. (continued)	"Diana Twin"	60 × 52	138 W	Normal heat dissipation for each half	Peach	Soft fleecy blanketing	To B.S.S.2612, D/P neon switches for each half	£5 17 6	£1 3 5
	"Delia"	50 × 44	92 W	Normal heat dissipation	Peach	Soft fleecy blanketing	To B.S.S.2612, D/P neon switch	£3 19 6	£0 15 9
Covers are available for all the foregoing Ekco models.									
<b>ELECTRIC BED-WARMERS, LTD.,</b> Quality Works, Waterside, Todmorden, Lancs.	"Bedtime Bliss" single	30 × 54	120 W	Three-heat switch	Pink, blue, gold or green	Duplex cloth whipped with wool	"Calomatique z" long-life element	£5 4 6	£0 19 9
	"Bedtime Bliss" double	50 × 60	200 W	Two three-heat switches, dual control	Pink, blue, gold or green	Duplex cloth whipped with wool	"Calomatique z" long-life element, dual control	£10 9 0	£1 19 5
	"Calora" pad De-luxe major	13 × 8	80 W	Three-heat switch	White	Duplex cloth	Guaranteed two years	£3 2 3	£0 11 9
	"Calora" single	54 × 27	90 W	On/off switch	Pink or blue	Raised fabric	"Calomatique z" long-life element	£3 3 7	£0 12 9
	"Calora" double	60 × 42	160 W	On/off switch	Pink or blue	Raised fabric	"Calomatique z" long-life element	£6 0 0	£1 2 11
<b>ELECTROWARM, LTD.,</b> Nethergate Street, Bungay, Suffolk.	"Popular" single	54 × 25	60 W	D/P switch	Peach, rose or blue	Fleecy blanket cloth	Bound satin ribbon	£2 10 0	£0 10 1
	"Monarch" double	54 × 52	120 W	D/P neon switch	Peach, rose or blue	Fleecy blanket cloth	Bound satin ribbon	£5 0 0	£1 0 2
	"Elite" single	54 × 30	70 W	D/P neon switch	Peach, rose or blue	Flameproof blanket cloth	Bound satin ribbon	£3 5 0	£0 13 0
	"Elite" double	54 × 54	120 W	Variable heat switch	Peach, rose or blue	Flameproof blanket cloth	Bound satin ribbon	£6 15 0	£1 7 2
	"Monarch Twin" double	54 × 52	60 W each side	Dual control neon switches	Peach, rose or blue	Flameproof blanket cloth	Bound satin ribbon	£6 10 0	£1 6 2
<b>S. I. ENGEL &amp; CO.,</b> 23-5, Kensington Park Road, London, W.11.	"L'Exquisite"	12 × 16	60 W	Three-heat switch	White	Flannelette	Complete with washable cover, two thermostats	£2 0 8	£0 7 6
<b>ETCHES &amp; WELLS, LTD.,</b> Tudor Works, Codicote, Herts.	"Wellco" single W.S.2	54 × 26	50 W	D/P neon on/off switch	Peach	Raised cotton	Satin bound	£2 17 0	£0 11 5
	"Wellco" double W.D.2	54 × 42	100 W	D/P neon on/off switch	Peach	Raised cotton	Satin bound	£4 2 6	£0 16 5



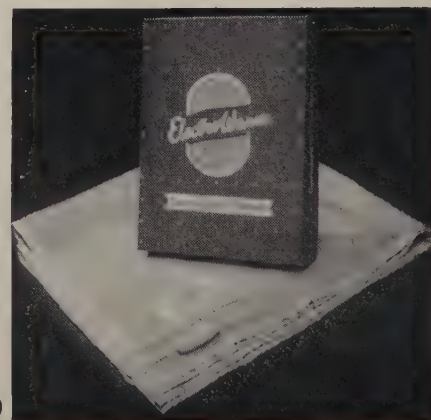
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7. Electric Beawarmers "Bedtime Bliss" blankets
8. David Griffin "Dee-Gee" low-voltage blanket with transformer
9. Easipower "Dreamland" 3-heat luxury blanket
10. "Electro-Warm" luxury blanket



Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
<b>GOBLIN (B.V.C.), LTD.,</b> Goblin Works, Leatherhead, Surrey.	"Goblin" B.1	52 x 27	60 W	Single-heat	Blue or pink	Fleecy mixture	Made to B.S.S.2612	£4 2 5	£0 16 7
	"Goblin" B.2	52 x 42	85 W	Single-heat	Blue or pink	Fleecy mixture	Made to B.S.S.2612	£5 17 1	£1 3 6
	"Goblin" G	52 x 30	60 W	Three-heat	Blue or pink	Fleecy mixture	Made to B.S.S.2612	£6 2 7	£1 4 7
<b>DAVID GRIFFIN, LTD.,</b> Wimborne Road, Poole, Dorset.	"Dee Gee" SB/SU	70 x 34	105 W	Three-heat switch through transformer	Pink and blue	Wool mixture	Operates at 12 V	£9 7 10	£0 18 8
	"Dee Gee" TSB/DU	70 x 34 (twin)	2 x 105 W	Three-heat switch through transformer, dual control	Pink and blue	Wool mixture	Operates at 12 V	£17 14 8	£1 17 4
	"Dee Gee" DB/DU	70 x 54	2 x 90 W	Three-heat switch through transformer, dual control	Pink and blue	Wool mixture	Operates at 12 V	£16 17 9	£1 14 0
	"Dee Gee" DB/TSU	70 x 54	2 x 90 W	Three-heat switch through transformer, dual control	Pink and blue	Wool mixture	Operates at 12 V	£17 18 9	£1 14 0
<b>H.M.V. DOMESTIC APPLIANCES, LTD.,</b> 363, Oxford Street, London, W.1.	SBI	24 x 60	60 W	Neon on/off switch	Fawn, pink satin edge	Wool	Made to B.S.S.2612	£4 8 9	£0 17 11
	DBI	43 x 60	108 W	Neon on/off switch	Fawn, pink satin edge	Wool	Made to B.S.S.2612	£6 11 0	£1 6 5
<b>HOLT ENGG. &amp; MANUFACTURING CO., LTD.,</b> Hemco Works, 210, Stockport Road, Manchester, 13.	"Hesco"	17 x 11 (a), 22 x 14 (b), 22 x 14 (c)	33 W (a), 30 W (b), 60 W (c)	Single-heat switch (a & b), three-heat switch (c)	Fawn	Woollen	White linen and/or waterproof cover 5/- extra	£2 0 0 (a) £3 10 0 (b) £3 15 0 (c)	£0 8 0 (a) £0 13 9 (b) £0 14 10 (c)
	"Hesco"	47 x 32	125 W (a), 260 W (b)	Single-heat switch (a), three-heat switch (b)	White	Woollen	White linen and/or waterproof cover £1 extra	£5 0 0 (a) £6 15 0 (b)	£0 19 10 (a) £1 6 8 (b)
	"Hesco"	60 x 48	520 W	Three-heat dual switch	White	Woollen	White linen and/or waterproof cover 30/- extra	£12 0 0	£2 7 7
<b>ROBERT HOLT (MIDDLESEX), LTD.,</b> Florence Road, London, N.18.	"Solwarm" No. 1	52 x 54	140 W	Thermostat	Pink/peach	Swansdown	Illuminated D/P switch	£6 5 10	£1 3 10
	"Solwarm" 1S	52 x 54	155 W	Thermostat	Pink/peach	Swansdown	Illuminated D/P switch	£5 8 9	£1 0 8
	"Solwarm" 2L	44 x 52	115 W	Thermostat	Pink/peach	Swansdown	Illuminated D/P switch	£4 9 6	£0 17 1
	"Solwarm" 2	36 x 52	105 W	Thermostat	Pink/peach	Swansdown	Illuminated D/P switch	£3 18 11	£0 14 11
	"Solwarm" 3	28 x 52	65 W	Thermostat	Pink/peach	Swansdown	Illuminated D/P switch	£3 6 1	£0 12 7
	"Solwarm" 4	18 x 52	50 W	Thermostat	Pink/peach	Swansdown	Illuminated D/P switch	£2 17 6	£0 11 0
	"Solwarm" 5 (Pad)	12 x 16	40 W	Thermostat	Off white	Flannelette	S/P switch	£1 9 10	£0 5 8
	"Solwarm" 6FW	36 x 50	105 W	Thermostat	White	Linen covered	Fire and water resistant D/P switch	£5 8 9	£1 0 8
	"Solwarm" 65FW	18 x 50	50 W	Thermostat	White	Linen covered	Fire and water resistant D/P switch	£3 12 4	£0 13 11
Washable covers available (except for Pad). "Ceetherm" 10-heat switch 29/6 extra.									
<b>ISOPAD, LTD.,</b> Barnet By-Pass, Boreham Wood, Herts.	"Lana" BS	60 x 80 (36 + 54 heated)	100 W	Three-heat switch	Pink, green and blue	Pure wool	Made to B.S.S.2612	£9 0 0	£1 16 1
	"Lanette" single	36 x 54	100 W	Three-heat switch	Pink, green and blue	Pure wool	Made to B.S.S.2612	£6 0 0	£1 4 2
	"Lanette" double	60 x 54	160 W	Dual control, three-heat switches	Pink, green and blue	Pure wool	Made to B.S.S.2612	£11 0 0	£2 4 2
<b>F. MARSHALL (TEXTILES), LTD.,</b> Hollins Mill, Marsh, Huddersfield. (continued on next page)	"Martex" single Kite	26 x 56	62 W	Single-heat D/P switch	Pastel pink	Cotton and rayon, flameproofed	Made to B.S.S.2612	£3 12 1	£0 14 4
	"Martex" double Kite	50 x 56	2 x 62 W	Single S/P switch each half	Pastel pink	Cotton and rayon, flameproofed	Made to B.S.S.2612	£6 4 0	£1 4 8
	"Martex" three-quarter Kite	37 x 50	77 W	Single-heat D/P switch, neon	Pastel pink	Cotton and rayon, flameproofed	Made to B.S.S.2612	£3 18 9	£0 15 8

11. H.M.V. Domestic Appliances DBI blanket  
 12. Milliwatt "Regal Standard" blanket  
 13. "Dorchester" blanket (Ekco Heating & Electrical, Ltd.)  
 14. Morphy-Richards "Regent" blanket



11



12



13

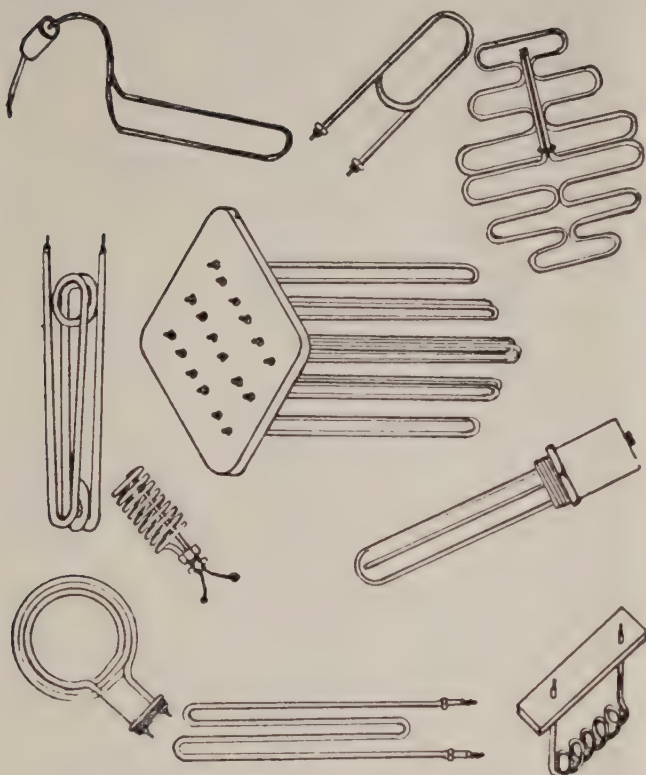


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Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
<b>F. MARSHALL (TEXTILES), LTD.,</b> Hollins Mill, Marsh, Huddersfield. (continued)	"Martex" single	26 × 50	62 W	Single-heat D/P switch	Pastel pink	Cotton and rayon, flameproofed	—	£3 8 3	£0 13 7
	"Martex" double	48 × 50	2 × 62 W	Single S/P switch each half	Pastel pink	Cotton and rayon, flameproofed	—	£5 11 8	£1 2 2
<b>MILLIWATT, LTD.,</b> 44, Princess Road, Regent's Park, London, N.W.1.	"Milliwatt" standard pad	13½ × 15	80 W	Three-heat, duplicate thermostats	Pink, blue or gold	Wool felt interior	Fleecy cover, moisture proof interior	£3 5 0	£0 13 0
	"Milliwatt" standard pad	13½ × 15	40 W	Single-heat, duplicate thermostats	Pink, blue or gold	Wool felt interior	Fleecy cover, moisture proof interior	£2 0 0	£0 8 0
	"Milliwatt" double pad	15 × 26	100 W	Three-heat, duplicate thermostats	Pink, blue or gold	Wool felt interior	Fleecy cover, moisture proof interior	£4 15 0	£0 18 10
	"Milliwatt" double pad	15 × 26	50 W	Single-heat, duplicate thermostats	Pink, blue or gold	Wool felt interior	Fleecy cover, moisture proof interior	£3 5 0	£0 13 0
	M.21 "Warmer"	12 × 9	40 W	Single-heat, duplicate thermostats	Pink, blue or green	Wool felt interior	Waterproof "Vynide" cover	£0 18 4	£0 3 8
	"Regal Standard" single bed	60 × 25	100 W	Single-heat, duplicate thermostats	Pink, blue or golden yellow	Wool felt interior	Fleecy cover, ribbon trim	£5 0 0	£0 18 10
	"Regal Standard" double bed	55 × 48	130 W (a) 160 W (b)	Single-heat (a). Three-heat (b), duplicate thermostats	Pink, blue or golden yellow	Wool felt interior	Fleecy cover, ribbon trim	£7 5 0 (a) £8 13 4 (b)	£1 7 4 (a) £1 12 9 (b)
	"Regal Standard" single bed	60 × 30	170 W	Three-heat, duplicate thermostats	Pink, blue or golden yellow	Wool felt interior	Fleecy cover, ribbon trim	£6 18 4	£1 6 2
	"Regal Standard" Dual control double bed	60 × 50	200 W (a) 280 W (b)	Single-heat (a). Three-heat (b), duplicate thermostats	Pink, blue or golden yellow	Wool felt interior	Fleecy cover, ribbon trim	£13 0 0 (a) £16 0 0 (b)	£2 9 0 (a) £3 0 5 (b)
	"Extra"	60 × 30	100 W	Three-heat, duplicate thermostats	Pink, blue or gold	Thick blanket cloth	Fleecy with ribbon edging	£5 0 0	£0 19 9
	Double "Extra"	60 × 48	160 W	Three-heat, duplicate thermostats	Pink, blue or gold	Thick blanket cloth	Fleecy with ribbon edging	£7 3 9	£1 8 9
	"Autocrat" single	60 × 24	59 W	Five-position three-heat switch	Pink, blue or gold	Thick blanket cloth	Fleecy with ribbon edging	£2 15 6	£0 11 0
	"Autocrat" double	60 × 44	106 W	Five-position three-heat switch	Pink, blue or gold	Thick blanket cloth	Fleecy with ribbon edging	£4 4 7	£0 16 9



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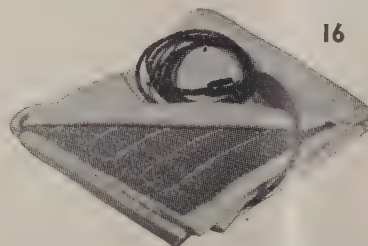
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Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
<b>MONOGRAM ELECTRIC, LTD.,</b> Gatwick Road, Crawley, Sussex.	G.A.11 single	60 × 85	140 W	Variable	Pink, green or blue	Wool blend	"Sleep-guard" safety circuit	£9 15 3	£1 19 4
	G.A.12 double	80 × 85	190 W	Variable	Pink, green or blue	Wool blend	"Sleep-guard" safety circuit	£11 10 10	£2 6 5
	G.A.13 dual	80 × 85	190 W	Variable	Pink, green or blue	Wool blend	"Sleep-guard" safety circuit	£13 6 5	£2 13 5
	G.U.1 underblanket	40 × 60	190 W	Variable	Pink	Wool blend	"Sleep-guard" safety circuit	£7 3 8	£1 8 10
<b>MORPHY-RICHARDS (CRAY), LTD.,</b> 50, Conduit Street, London, W.1.	"New Popular" BBA4	48 × 26	52 W	Thermostatic safety cut-out	Pink	Flameproofed Wool/cotton/fibro	Made to B.S.S.2612. Satin bound. Loops at corners	£3 7 4	£0 13 5
	"New Popular" BCA4	48 × 44	94 W	Thermostatic safety cut-out	Pink	Flameproofed Wool/cotton/fibro	Made to B.S.S.2612. Satin bound. Loops at corners	£4 15 4	£0 18 11
	"Regent" BSU3A	60 × 26	85 W	Single-heat D/P switch, thermostatic	Peach, pink, blue	Flameproofed fleecy material	Made to B.S.S.2612. Satin bound edges	£4 14 5	£0 18 10
	"Regent" BDU3A	60 × 45	168 W	Single-heat D/P switch, thermostatic	Peach, pink, blue	Flameproofed fleecy material	Made to B.S.S.2612. Satin bound edges	£6 15 1	£1 6 10
	"Imperial" BEU3A	60 × 28	95 W	Three-heat D/P switch, thermostatic	Peach, pink, blue	Flameproofed fleecy material	Made to B.S.S.2612. Satin bound edges	£5 18 0	£1 3 6
	"Imperial" BFU3A	60 × 47½	174 W	Three-heat D/P switch, thermostatic	Peach, pink, blue	Flameproofed fleecy material	Made to B.S.S.2612. Satin bound edges	£8 9 0	£1 13 7
<b>MOSSLEY BLANKET &amp; CARPET CO., LTD.,</b> Kosywol House, Mossley, Lancs. (continued on next page)	"Kosywol" S.M.1 (a) and S.M.3 (b)	54 × 27	75 W	Non-illuminated (a) or neon (b) D/P switch	Rose, blue, green or white	Fibro blend wool content	Waterproof element	£2 12 3 (a) £2 16 4 (b)	£0 10 4 (a) £0 11 2 (b)
	"Kosywol" S.M.2 (a) and S.M.4 (b)	54 × 48	150 W	Non-illuminated (a) or neon (b) D/P switch	Rose, blue, green or white	Fibro blend wool content	Waterproof element	£4 14 1 (a) £4 18 2 (b)	£0 18 8 (a) £0 19 6 (b)
	"Kosywol" S.M.5	54 × 48	150 W	Twin torpedo switches	Rose, blue, green or white	Fibro blend wool content	Waterproof element, dual control	£5 12 5	£1 2 3
	"Kosywol" S.M.6	36 × 24	45 W	D/P switch	Rose	Fibro blend wool content	Waterproof element	£2 1 8	£0 8 3
	"Kosywol" S.M.7	48 × 24	60 W	D/P switch	Rose or gold	Fibro blend wool content	Waterproof element	£2 6 8	£0 9 3
	"Kosywol" S.M.8	48 × 40	90 W	D/P switch	Rose	Fibro blend wool content	Waterproof element	£3 11 2	£0 14 1
	"Kingfisher" K.F.1	54 × 27	75 W	D/P neon switch	Kingfisher blue, red, rose, blue or lemon	All wool velour	Waterproof element	£3 15 0	£0 14 10
	"Kingfisher" K.F.2	54 × 48	150 W	D/P neon switch	Kingfisher blue, red, rose, blue or lemon	All wool velour	Waterproof element	£5 15 9	£1 3 0
	"Story Book" pram blanket	26 × 14	17 W	D/P neon switch	Multicolour plastic print	Wool	Waterproof element	£2 5 9	£0 9 1
	"Kosywol" L.V.1	54 × 27	75 W	24 V on/off switch	Rose	Fibro blend wool content	Three-heat low-voltage control unit £6 13 6 extra	£3 15 0	£0 14 10
	"Kosywol" L.V.2	54 × 48	150 W	24 V on/off switch	Rose	Fibro blend wool content	Three-heat low-voltage control unit £6 13 6 extra	£5 5 10	£1 1 0

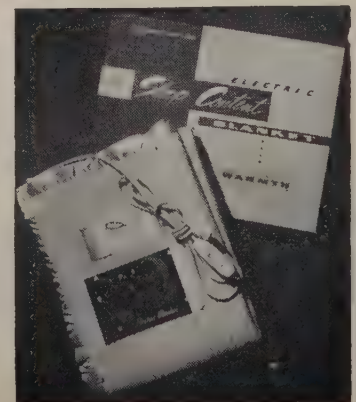
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15. Pifco "Popular" blanket  
16. Wye Valley Hand Weavers blanket  
17. "Sleep Content" blanket





Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
<b>MOSSLEY BLANKET &amp; CARPET CO., LTD.,</b> Kosywool House, Mossley, Lancs. (continued)	"Kosywool Superior" K.M.15 (a) and K.M.17 (b)	54 x 27	65 W	Non-illuminated (a) or neon (b) D/P switch	Rose or blue	Flameproofed fibro/wool	Made to B.S.S.2612	£3 0 4 (a) £3 4 7 (b)	£0 12 0 (a) £0 12 10 (b)
	"Kosywool Superior" K.M.16 (a) and K.M.18 (b)	54 x 48	130 W	Non-illuminated (a) or neon (b) D/P switch	Rose or blue	Flameproofed fibro/wool	Made to B.S.S.2612	£4 15 8 (a) £4 19 11 (b)	£0 19 0 (a) £0 19 11 (b)
	"Kosywool Superior" K.M.19	54 x 54	130 W	Twin torpedo switches	Rose or blue	Flameproofed fibro/wool	Made to B.S.S.2612, Dual control	£6 0 8	£1 4 0
	"Kosywool Superior" K.M.20	54 x 27	60 W	D/P neon switch	Rose or Blue	Flameproofed all-wool velour	Made to B.S.S.2612	£4 6 3	£0 17 4
	"Kosywool Superior" K.M.21	54 x 48	130 W	D/P neon switch	Rose or blue	Flameproofed all-wool velour	Made to B.S.S.2612	£6 18 6	£1 7 6
"Ceetherm" 40-stage variable heat control for use on 230/250 V a.c. £2 5 9 extra.									
<b>MULTI-SPRING, LTD.,</b> 23, Streatham Road, Mitcham, Surrey.	Quilted overlay	30 x 75 or 36 x 75	100 to 140 W according to size	Three-heat, neon safety light	Red, blue, green or lilac	Cotton felt, damask covered	Corner caps to fit any size mattress	£7 18 0	£1 7 0
	Quilted overlay	42 x 75		Three-heat, neon safety light	Red, blue, green or lilac	Cotton felt, damask covered	Corner caps to fit any size mattress	£9 1 9	£1 10 9
	Quilted overlay	48 x 75 or 54 x 75		Three-heat, neon safety light	Red, blue, green or lilac	Cotton felt, damask covered	Corner caps to fit any size mattress	£9 16 8	£1 13 4
<b>PHILIPS ELECTRICAL, LTD.,</b> Century House, Shaftesbury Avenue, London, W.C.2.	EA.1213 single	60 x 28	75 W	Three-heat switch	Peach or blue	Pure wool	Made to B.S.S.2612	£6 0 6	£1 4 3
	EA.1223 double	60 x 48	130 W	Three-heat switch	Peach or blue	Pure wool	Made to B.S.S.2612	£9 9 4	£1 18 1
	EA.1210 (a) and EA.1210/I (b) single	60 x 25	72 W	Single-heat	Gold (a), pink (b)	Fleecy wool	Made to B.S.S.2612	£4 8 2	£0 17 9
	EA.1220 (a) and EA.1220/I (b) double	60 x 43	125 W	Single-heat	Gold (a), pink (b)	Fleecy wool	Made to B.S.S.2612	£6 9 2	£1 6 0
	EA.1212	50 x 26	60 W	Single-heat	Amber	Cotton/rayon	Made to B.S.S.2612	£3 2 1	£0 12 6
	EA.1222	50 x 42	100 W	Single-heat	Amber	Cotton/rayon	Made to B.S.S.2612	£3 19 10	£0 16 1
<b>PIFCO, LTD.,</b> Watling Street, Manchester, 4. (continued on next page)	"Favourite" 1267 single	48 x 26	56 W	Self-compensating element	Gold, pink and eau-de-nil	Heavy cotton twill	Satin binding. Made to B.S.S.2612	£2 15 5	£0 11 1
	"Favourite" 1268 double	48 x 40	90 W	Self-compensating element	Gold, pink and eau-de-nil	Heavy cotton twill	Satin binding. Made to B.S.S.2612	£3 11 10	£0 14 6
	"Celebrity" 1367 single	60 x 24	63 W	Self-compensating element	Gold, pink and eau-de-nil	Heavy cotton twill	Satin binding. Made to B.S.S.2612	£3 3 5	£0 12 9
	"Celebrity" 1368 double	60 x 42	120 W	Self-compensating element	Gold, pink and eau-de-nil	Heavy cotton twill	Satin binding. Made to B.S.S.2612	£4 4 2	£0 16 10
	"Popular" 1167 single	60 x 24	63 W	Self-compensating element	Gold, pink and eau-de-nil	Wool and rayon mixture	Satin binding. Made to B.S.S.2612	£3 19 11	£0 16 1
	"Popular" 1168 double	60 x 42	120 W	Self-compensating element	Gold, pink and eau-de-nil	Wool and rayon mixture	Satin binding. Made to B.S.S.2612	£6 0 1	£1 4 1
	"De-Luxe" 2263 single	62 x 28	120 W	Thermostatic	Gold, peach, powder blue	Pure wool	Satin binding. Made to B.S.S.2612	£7 3 9	£1 8 11
	"De-Luxe" 2264 double	62 x 42	186 W	Thermostatic	Gold, peach, powder blue	Pure wool	Satin binding. Made to B.S.S.2612	£10 8 0	£2 1 10
	"Favourite" 2367 single three-heat	40 x 27	56 W	Self-compensating element	Gold, pink and eau-de-nil	Heavy cotton twill	Satin binding. Made to B.S.S.2612	£3 11 10	£0 14 6
	"Favourite" 2368 double three-heat	48 x 42	90 W	Self-compensating element	Gold, pink and eau-de-nil	Heavy cotton twill	Satin binding. Made to B.S.S.2612	£4 14 3	£0 19 0
	"Popular" 2467 single three-heat	60 x 25	63 W	Self-compensating element	Gold, pink and eau-de-nil	Wool and rayon mixture	Satin binding. Made to B.S.S.2612	£4 18 1	£0 19 8

Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
PIFCO, LTD., Watling Street, Manchester, 4. (continued)	"Popular" 2468 double three-heat	60 x 44	120 W	Self-compensating element	Gold, pink and eau-de-nil	Wool and rayon mixture	Satin binding. Made to B.S.S.2612	£7 3 6	£1 8 10
	1271 Heating pad	16 x 12	65 W	Thermostatic	Candy striped	Felt and sanforised fabric	Removable cover. Made to B.S.S.1789	£2 8 7	£0 9 10
	1273 Heating pad three-heat	16 x 12	65 W	Thermostatic	Candy striped	Felt and sanforised fabric	Removable cover. Made to B.S.S.1789	£3 11 5	£0 14 5
	"All-Night" low-voltage single 2267	70 x 34	70 W	Separate control unit available	Pink or gold	Wool and rayon mixture	Satin binding	£4 10 11	£0 18 3
	"All-Night" low-voltage double 2268	70 x 54	150 W	Separate control unit available	Pink or gold	Wool and rayon mixture	Satin binding	£8 4 0	£1 13 0
Control units for l.v. blankets 102/6 each (two required for double blanket)									
"SLEEP CONTENT" APPLIANCES, 32, Westgate, Huddersfield.	"Sleep Content"	50 x 25	58 W	Self-compensating element	Peach	Cotton and wool mixture. Flameproofed	Made to B.S.S.2612	£2 13 3	£0 10 9
	"Sleep Content"	50 x 38	90 W	Self-compensating element	Peach	Cotton and wool mixture. Flameproofed	Made to B.S.S.2612	£3 15 5	£0 15 3
STANLEY BROS. OF ALDERSHOT, LTD., North Lane, Aldershot, Hants.	"Cumfee" Standard Junior	50 x 25	63 W	Self-compensating element	Peach	Fleecy cotton cover	Flameproofed hessian foundation	£2 12 0	£0 10 4
	"Cumfee" Standard Senior	60 x 27	85 W	Self-compensating element	Peach	Fleecy cotton cover	Flameproofed hessian foundation	£3 5 0	£0 12 10
	"Cumfee" Standard double	50 x 40	105 W	Self-compensating element	Peach	Fleecy cotton cover	Flameproofed hessian foundation	£3 15 0	£0 14 11
	"Cumfee" De-Luxe single	54 x 26	67 W	Self-compensating element	Peach	Flameproofed blanket cloth	Made to B.S.S.2612. D/P neon switch	£2 19 0	£0 11 11
	"Cumfee" De-Luxe double	54 x 44	115 W	Self-compensating element	Peach	Flameproofed blanket cloth	Made to B.S.S.2612. D/P neon switch	£4 4 0	£0 16 8
SUTCLIFFE & CLARKSON, LTD., Spa Street Works, Burnley, Lancs.	"Little Gem"	53 x 25	60 W	On/off switch	Blue	Rayon/cotton duplex	Made to B.S.S.2612	£3 2 0	£0 11 10
	"Double Gem"	53 x 40	95 W	Three-heat switch	Blue	Rayon/cotton duplex	Made to B.S.S.2612	£4 2 4	£0 15 9
	SS	53 x 25	60 W	Illuminated on/off switch	White	Wool mixture	Made to B.S.S.2612	£3 15 0	£0 14 4
	DS	53 x 40	95 W	Illuminated on/off switch	White	Wool mixture	Made to B.S.S.2612	£4 19 3	£0 19 0
	D.3	53 x 40	95 W	Three-heat switch	White	Wool mixture	Made to B.S.S.2612	£5 2 8	£0 19 7
	VR.1	53 x 25	60 W	Illuminated on/off switch	Blue	Wool mixture	Made to B.S.S.2612	£4 11 0	£0 17 5
	VR.2	53 x 40	95 W	Illuminated on/off switch	Blue	Wool mixture	Made to B.S.S.2612	£6 3 0	£1 3 7
	VR.3	53 x 40	95 W	Three-heat switch	Blue	Wool mixture	Made to B.S.S.2612	£6 6 6	£1 4 2
	HS.3	57 x 26	95 W	Three-heat thermostatic	Pink	Wool mixture	P.V.C. insulated elements	£5 17 0	£1 2 4
	HD.3	57 x 43	160 W	Three-heat thermostatic	Pink	Wool mixture	P.V.C. insulated elements	£7 7 6	£1 8 3
THERMALUX ELECTRICAL PRODUCTS, LTD., 14-16, Hall Street, Halifax, Yorks.	"Sleepwell" blanket	30 x 54	65 W	On/off switch	Pink	All wool	Made to B.S.S.2612	£5 15 0	£1 2 10
	Mattress overlay M	27 x 48	85 W	On/off switch	Pink, green or blue	Wool wadding, damask cover	Quilted	£6 9 2	£1 5 8
	Mattress overlay J	27 x 72	125 W	On/off switch	Pink, green or blue	Wool wadding, damask cover	Quilted	£8 6 8	£1 13 1
	Mattress overlay OSB	36 x 72	180 W	On/off switch	Pink, green or blue	Wool wadding, damask cover	Quilted	£11 5 0	£2 4 8
	Mattress overlay DB	54 x 72	250 W	On/off switch	Pink, green or blue	Wool wadding, damask cover	Quilted	£15 4 2	£3 0 4
	Mattress overlay DB2	54 x 72	250 W	On/off switch, dual control	Pink, green or blue	Wool wadding, damask cover	Quilted	£17 15 0	£3 10 6

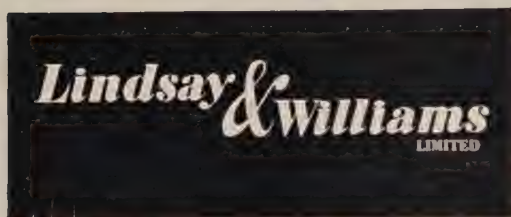




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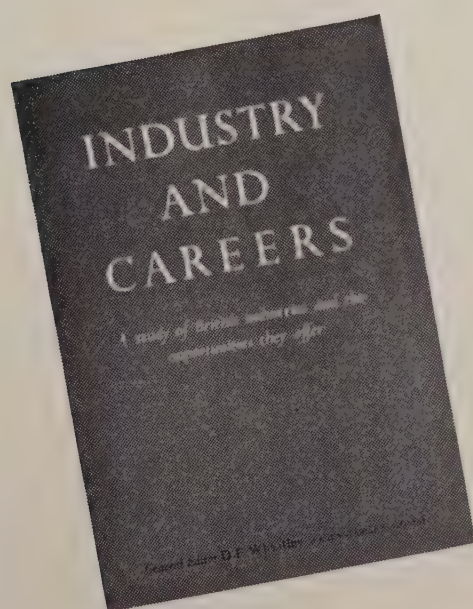
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BRITISH RAILWAYS

Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
THERMEGA, LTD., 37, Thurloe Street, London, S.W.7.	"Duchy" 6032 PC	60 x 32	125 W	Thermostatic 10-position control switch	Apricot	Rayon/cotton mixture	Made to B.S.S.2612	£6 18 0	£1 7 5
	"Duchy" 6050 PC	60 x 50	190 W	Thermostatic 10-position control switch	Apricot	Rayon/cotton mixture	Made to B.S.S.2612	£9 10 0	£1 17 10
	"County" 6032	60 x 32	92 W	Single-heat, non-thermostatic	Apricot	Fibro-mixture	Made to B.S.S.2612	£3 15 10	£0 15 1
	"County" 6050	60 x 50	145 W	Single-heat, non-thermostatic	Apricot	Fibro-mixture	Made to B.S.S.2612	£6 2 10	£1 4 5
	"Planet" 5024	50 x 24	55 W	Single-heat, non-thermostatic	Honeysuckle	Fibro-mixture	Made to B.S.S.2612	£2 17 2	£0 11 5
	"Planet" 5044	50 x 44	100 W	Single-heat, non-thermostatic	Honeysuckle	Fibro-mixture	Made to B.S.S.2612	£4 4 4	£0 16 9
	Medical blanket BM4830/3	48 x 30	240 W	Thermostatic three-heat control	White	Wool felt, cotton cover	Medical and hospital model	£10 10 0	£2 1 9
	Pad P1612/I	16 x 12	46 W	Single-heat	Pink or blue	Soft fleecy material	—	£2 2 8	£0 8 6
	Pad 1612/3	16 x 12	90 W	Three-heat, thermostatic	Pink or blue	Soft fleecy material	Complete with washable cover	£3 5 0	£0 13 0
	Pad P2416/M	24 x 16	120 W	Thermostatic, 10-position control switch	Pink or blue	Soft fleecy material	Complete with washable cover	£5 1 3	£1 0 1
THERMEX MANUFACTURING CO., Elland, Yorkshire.	"Popular" (single)	50 x 26	60 W	D/P Neon switch	Pink or gold	All wool	Made to B.S.S.2612	£2 16 0	£0 9 11
	"Popular" (double)	50 x 48	115 W	D/P Neon switch	Pink or gold	All wool	Made to B.S.S.2612	£4 4 10	£0 15 0
THERMOELECTRICS, LTD., Chapel Works, Church Street, Hampton-on-Thames.	"Siesta" SBA and SBA-K	60 x 30	90 W	Natural heat dissipation	Rose, pastel pink	Mixture	Neon indicator switch. (SBA-K made to B.S.S.2612)	£3 2 0 £3 10 0 (SBA-K)	£0 12 6 £0 13 11 (SBA-K)
	"Siesta" DBA and DBA-K	60 x 50	135 W	Natural heat dissipation	Rose, pastel pink	Mixture	Neon indicator switch. (DBA-K made to B.S.S.2612)	£5 0 0 £5 10 0 (DBA-K)	£0 19 11 £1 1 10 (DBA-K)
	"Nova"	48 x 26	56 W	Natural heat dissipation	Pink or peach	Mixture	Statin bound all round	£2 8 0	£0 9 6
THERMOSET APPLIANCES, LTD., Chapel Works, Failsworth, Manchester.	"New Era"	50 x 30 (standard) 60 x 24 (single)	95 W	Single-heat. Variable heat control unit 39/6 extra	Pale green and cream	"Duplex" material (cotton)	Cover 16/- extra. Made to B.S.S.2612	£5 16 0	£1 3 4
	"Cozee" (single)	60 x 30	75 W	Single-heat. Variable heat control unit 39/6 extra	Pale green	"Duplex" material (cotton)	Cover 18/- extra. Made to B.S.S.2612	£4 0 0	£0 16 0
	"Cozee" (double)	60 x 50	140 W	Single-heat. Variable heat control unit 39/6 extra	Pale green and cream	"Duplex" material (cotton)	Cover 24/- extra. Made to B.S.S.2612	£6 0 0	£1 4 1
	"Everest" (single)	48 x 26	58 W	Single-heat. Variable heat control unit 39/6 extra	Pale green	Cotton	Cover 18/- extra. Made to B.S.S.2612	£2 19 0	£0 11 10
	"Everest" (double)	48 x 44	92 W	Single-heat. Variable heat control unit 39/6 extra	Pale green	Cotton	Cover 22/- extra. Made to B.S.S.2612	£4 4 0	£0 16 10
WARMABED, LTD., Hollingworth Lane, Knottingley, Yorks.	"Warmabed" de-luxe double	60 x 44	135 W	Single (a) or three-heat (b) switches (neon)	Honeysuckle, periwinkle blue, green and pink	All wool	Five-heat conversion units available, price £3 3s and £3 17s 6d (with standard lamp) extra All blankets made to B.S.S.2612.	£9 3 6 £10 4 8 (b)	£1 14 8 £1 18 7 (b)
	"Warmabed" de-luxe single	60 x 28	90 W	Single (a) or three-heat (b) switches (neon)	Honeysuckle, periwinkle blue, green and pink	All wool		£6 8 4 £6 19 7 (b)	£1 4 2 £1 6 4 (b)
	"Warmabed" "Golden Rest"	60 x 44 (a), 60 x 28 (b)	135 W (a), 90 W (b)	Single-heat D/P switch	Honeysuckle	Flame-proofed brushed cotton		£5 11 0 £3 14 0 (b)	£1 0 11 £0 13 11 (b)
	"Warmabed" Standard	60 x 30 (a), 60 x 48 (b)	83 W (a), 130 W (b)	Single-heat, neon switch	Pink	Fireproofed brushed cotton, felt base		£4 4 11 £6 5 6 (b)	£0 16 1 £1 3 8 (b)



Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
<b>WARMALUX MANUFACTURING CO.,</b> Elland, Yorkshire.	Special single	50 × 26	60 W	Unswitched	Pink	Wool	Made to B.S.S. 2612	£1 18 1	£0 7 7
	Special double	50 × 48	115 W	Unswitched	Pink	Wool	Made to B.S.S. 2612	£3 7 6	£0 13 9
	De Luxe single	54 × 27	63 W	D/P neon switch	Pink, blue or gold	Wool	Made to B.S.S. 2612	£2 19 2	£0 11 11
	De Luxe double	54 × 48	120 W	D/P neon switch	Pink, blue or gold	Wool	Made to B.S.S. 2612	£4 17 3	£0 19 6
<b>WARMEX, LTD.,</b> 375, Milton Road, Cambridge.	"Warmex" Standard single	50 × 24	65 W	Self-compensating element, single-heat	Cream	Cotton	Illuminated safety switch. Made to B.S.S. 2612	£2 12 4	£0 11 2
	"Warmex" Standard large	50 × 30	100 W	Self-compensating element, three-heat	Cream	Cotton	Illuminated safety switch	£4 4 3	£0 17 3
	"Warmex" Standard double	50 × 48	130 W	Self-compensating element, single (a) and three-heat (b)	Cream	Cotton	Illuminated safety switch. Made to B.S.S. 2612 (a)	£5 4 9 (a) £6 12 3 (b)	£1 2 3 (a) £1 6 1½ (b)
	"Warmex" De-Luxe single	50 × 24	80 W	Thermostatic, single-heat	Cream	Cotton	Illuminated safety switch	£3 4 3	£0 14 7
	"Warmex" De-Luxe large	50 × 30	100 W	Thermostatic, three-heat	Cream	Cotton	Illuminated safety switch	£4 18 0	£1 0 1
	"Warmex" De-Luxe double	50 × 48	160 W	Thermostatic, single (a) and three-heat (b)	Cream	Cotton	Illuminated safety switch	£6 7 7 (a) £7 9 3 (b)	£1 6 0½ (a) £1 9 1½ (b)
	"Warmex" "Nylon" standard	50 × 24 (single) 50 × 48 (double)	65 W and 130 W	Self-compensating element, single-heat	White/red	"Nylon" fur fabric	Made to B.S.S. 2612	£4 4 7 (single) £8 8 2 (double)	£0 15 3 (single) £1 10 7½ (double)

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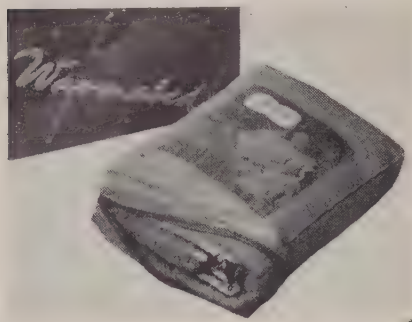
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18. "Warmabed" double blanket

19. Windak safety blanket with transformer



19

Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
<b>WARRANTY ELECTRICAL PRODUCTS CO.,</b> 210, West End Lane, London, N.W.6.	DBSA.3	60 x 50	300 W	Thermostatic and two three-heat switches	Cream, pink, sky blue, camel, green	Flannelette	Washable cover	£14 19 9	£2 17 9
	DBA.3	50 x 50	250 W	Thermostatic and two three-heat switches	Cream, pink, sky blue, camel, green	Flannelette	Washable cover	£12 18 0	£2 9 6
	SA.3	60 x 24	150 W	Thermostatic and three-heat switch	Cream, pink, sky blue, camel, green	Flannelette	Washable cover	£6 14 0	£1 5 6
	A.3	48 x 24	125 W	Thermostatic and three-heat switch	Cream, pink, sky blue, camel, green	Flannelette	Washable cover	£5 6 10	£1 0 8
	C.3	16 x 12	75 W	Thermostatic and three-heat switch	Cream, pink, sky blue, camel, green	Flannelette	Washable cover	£2 15 3	£0 10 3
	BW	48 x 24	60 W	On/off switch	Cream, pink, sky blue, camel, green	Flannelette	Washable cover	£3 4 4	£0 12 5
	DBW	50 x 50	120 W	On/off switch	Cream, pink, sky blue, camel, green	Flannelette	Washable cover	£7 2 0	£1 7 6
<b>WINDAK, LTD.,</b> Woodside, Poynton, Cheshire.	"Windak" single	33 x 71	75 W	Three-heat illuminated switch via transformer	Pink	Wool mixture, bound with satin	24V transformer £6 13 7 extra	£5 6 5	£1 2 0
	"Windak" double	42 x 71	140 W	Three-heat illuminated switch via transformer	Pink	Wool mixture, bound with satin	24V transformer £7 17 1 extra	£7 10 8	£1 11 1
	"Windak" twin	33 x 71	140 W	Three-heat illuminated switch via transformer	Pink	Wool mixture, bound with satin	24V transformer £7 17 2 extra	£10 12 10	£2 4 0
<b>WINTERWARM (BIRMINGHAM), LTD.,</b> Skelcher Road, Shirley, Solihull, Warwicks.	PSB.1 (a) and PSB (b)	24 x 48	56 W	Thermal balance, unswitched (a) D/P neon switch (b)	Pink or peach	Raised cotton, satin bound	Made to B.S.S.2612	£2 2 0 (a) £2 6 6 (b)	£0 8 5 (a) £0 9 4 (b)
	PDB	40 x 48	88 W	Thermal balance, D/P neon switch	Pink or peach	Raised cotton, satin bound	Made to B.S.S.2612	£3 10 0	£0 14 0
	SB	60 x 26	74 W	Thermal balance, D/P neon switch	Pink or peach	Raised cotton, satin bound	Made to B.S.S.2612	£3 3 5	£0 12 9
	DB	60 x 45	128 W	Thermal balance, D/P neon switch	Pink or peach	Raised cotton, satin bound	Made to B.S.S.2612	£4 4 2	£0 16 10
	SWB.2	54 x 27	63 W	Thermal balance, D/P neon switch	Pink or peach	Pure wool, satin bound	Made to B.S.S.2612	£3 15 0	£0 15 1
	DWB.2	54 x 48	124 W	Thermal balance, D/P neon switch	Pink or peach	Pure wool, satin bound	Made to B.S.S.2612	£5 10 0	£1 2 1
<b>WYE VALLEY HAND WEAVERS,</b> Ross-on-Wye, Herefordshire.	"Wye Valley"	54 x 31	70 W	Single-heat illuminated safety switch	Cream (a), blue, green or gold (b)	Flannelette cover	Hand woven element. Covers optional, white 20/- striped 22/-	£4 2 10 (a) £4 6 2 (b)	£0 17 1 (a) £0 17 9 (b)
	"Wye Valley"	54 x 60	140 W	Single-heat illuminated safety switch	Cream (a), blue, green or gold (b)	Flannelette cover	Hand woven element. Cover optional, white 40/-	£8 5 4 (a) £8 11 8 (b)	£1 14 1 (a) £1 15 4 (b)



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714A	Double Bed	60" x 50"	5 15 0	1 3 0	6 18 0

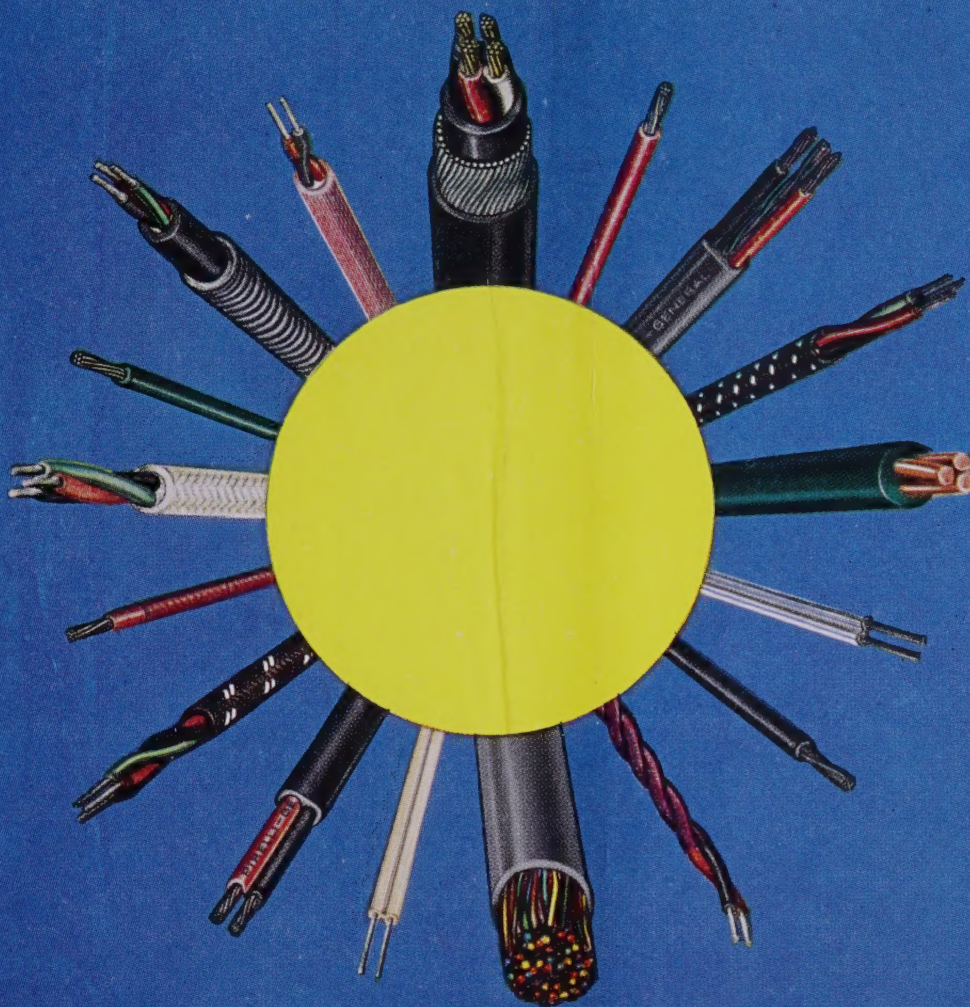
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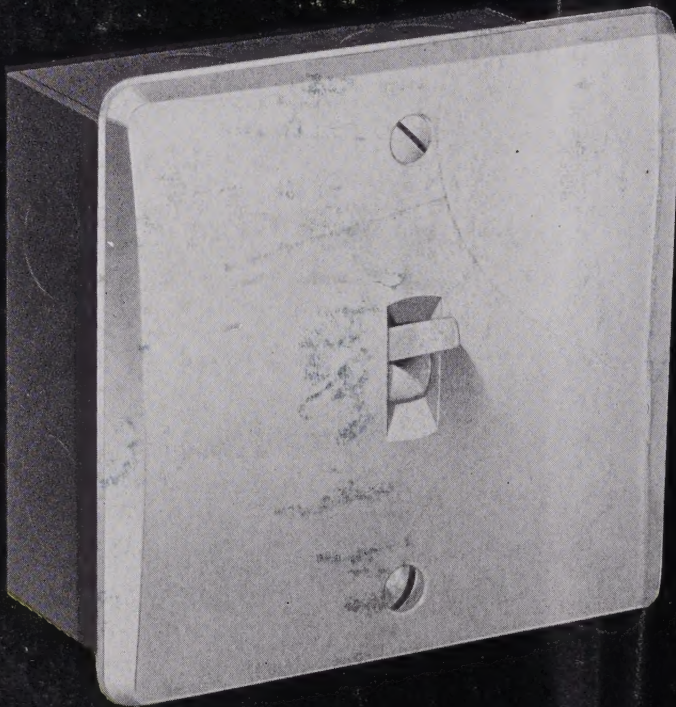


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